1980 C.B. ANNUAL REPORT

VOLUME I

SUMMARY OF DEVELOPMENT ACTIVITIES, COSTS AND ENVIRONMENTAL MONITORING

CATHEDRAL BLUFFS SHALE OIL COMPANY

TENNECO SHALE OIL COMPANY

OCCIDENTAL OIL SHALE INC., OPERATOR

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APRIL 30, 1981

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April 30, 1981

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Cathedral Bluffs
Shale Oil Company

FOREWORD

The 1980 C.B. ANNUAL REPORT is submitted to fulfill the requirements of Oil Shale Lease Number C-20341 as stated in Section 16(b) of the Lease, Section 1.(C)(4) of the Lease Environmental Stipulations, and Condition of Approval (No. 3) of the Detailed Development Plan issued on August 30, 1977. This report consists of the following volumes:

Volume 1 - Summary of Development Activities, Costs and Environmental Monitoring

Volume 2 - Environmental Analysis

Appendix 2A - Volume 2 Supporting Data

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1980 C.B. ANNUAL REPORT
VOLUME 1
SUMMARY OF DEVELOPMENT ACTIVITIES, COSTS AND ENVIRONMENTAL MONITORING

1.0 INTRODUCTION AND SUMMARY

This report summarizes the development activites, costs, and environmental monitoring on the Federal Oil Shale Lease Tract C-b during calendar year 1980. The tract is leased to Occidental Oil Shale, Inc. under U.S. Department of Interior Lease Number C-20341. It is managed by the equal-interest partnership between Occidental (the operator) and Tenneco Shale Oil Company, doing business as Cathedral Bluffs Shale Oil Company. The Tract is located in Rio Blanco County in the Piceance Creek basin of northwestern Colorado.

Principal activity in 1980, as in 1979, consisted of the sinking of three shafts with construction of attendant support facilities to dispose of mine water and store mined rock. The shaft-sinking of the 15-foot diameter Ventilation/Escape Shaft, started in January 1979, reached an approximate depth of 1,302 feet by year-end. Sinking of the 34-foot diameter Service Shaft, started in February 1979, reached a depth of approximately 1,522 feet by year-end. Sinking of the 29-foot diameter Production Shaft, started in April 1979, reached a depth of 1,606 feet below the surface by year-end. Water make for each of these shafts was as follows:

Shaft	1980 Average Water Make (gpm)	1980 Year-End Water Make (gpm)	Total for 1980 (10^6 gal)	Cumulative Total to Date (10^6 gal)
V/E	578	1002	303.8	346.5
Production and Service	391	611	205.4	223.5
TOTAL	969(115)	1613(247)	509.2(60.8)	570.0

Quantities for 1979 are shown in parentheses.

These values are shown on Table 4-4, which also presents water used for potable use, construction and dust control. In sinking these shafts and the attendant station development 11,400 cubic yards of shaft rock and 75,000 cubic yards of shale were mined requiring the use of 114 tons of explosives. "Shale" for purpose of segregation as required by OSO has been arbitrarily defined as that rock existing at depths greater than 960 feet below the surface, corresponding approximately to the top of the Parachute Creek member.

The surface water facilities are designed to dispose of excess mine water by direct discharge from two lower ponds ("A" and "B") under NPDES permit, or by sprinkler irrigation, or by subsurface reinjection into aquifers of like water quality. This system was initiated in 1979 for direct discharge from Ponds A or B into East No Name Gulch, thence to Piceance Creek. In 1980 the sprinkler system was completed and tested utilizing a lateral distribution system on the ridge between Cottonwood and Sorghum Gulches. Subsurface reinjection tests are underway as of March, 1981. In April, 1980, the installation of an acid storage

tank and associated piping to Ponds A and B were completed and put into use as the primary means of controlling the pH of the mine water prior to discharge or irrigation. A difficult suspended-solids situation prompted the redesign of the settling ponds and testing of chemical coagulants and flocculants in June. These test results were positive and resulted in the construction of a permanent flocculant addition system in November. This facility is located at Pond A and contained two 500-gallon mixing tanks and metering pumps with piping to Ponds A and B. The sprinkler system testing began the end of May after completion of Pond C. After testing, the system ran as scheduled into the middle of October. About 440 gpm was pumped through two movable nozzles, irrigating approximately 100 acres for a total of 39,300,000 gallons, or 8.5 acre-inches per acre, for the 1980 season.

In 1980 five offices were added to the tract temporary management facilities. In addition, two laboratories, a pipe fabrication shop, four buildings, a warehouse, a heliport, and a truck scale were added. Total project expenditures in 1980 were approximately $50.5 million compared to $30 million in 1979.

The number of additional acres disturbed during 1980 was 15.8. The areas disturbed are associated with the electrical power line switchyard (6.1 acres), the sewage treatment site (1.7 acres), the expansion of the raw shale storage pile (5 acres), and the continuation of the topsoil stockpile south of the support area (3 acres).

Other areas of construction activity during 1980 were included in previously disturbed areas. These include the power line substation (included in the 101 acres of the Mine Support Area graded in 1978), the L'eau Claire Sand Filter (included in the 30.2 acres of the irrigation system, disturbed in 1979), the Public Relations trailer and helipad (one acre where the old guard house was located, disturbed in 1978) and the truck weighing scales (part of the three acres of the traffic control station and guard house area, disturbed in 1978).

The number of acres reclaimed during 1980 was 3.3. These areas include the enlargement of the topsoil stockpile south of the support area (3 acres) and the topsoil stockpile at the sewage treatment site (0.3 acres).

At the year-end the on-Tract workforce reached 481, up from 270 of the previous year. The associated population was distributed as follows: Rifle 67%, Colorado River Valley 20%, Meeker 11%, and miscellaneous 2%. A fleet of five buses provided transportation from Rifle and Meeker to the Tract. C.B. personnel and its consultants continued to play an active role in the Mitigation Task Forces relative to socio-economic planning for the towns of Meeker, Rifle, and Rangely.

Environmental monitoring has continued as an on-going activity at the Tract since the completion of the two-year Baseline period (1974-1976). It encompasses air, water, noise, photography, and biology as well as studies of ecosystem interrelationships, toxicology, and health and safety. Results are briefly summarized in Section 9 of this volume and extensively analyzed in Volume 2 of this Annual Report. No significant environmental impacts have been noted to-date except for areas directly disturbed by construction, ponds, and mined rock disposal and for some localized drawdown of groundwater levels from mine dewatering.

For purposes of demonstrating compliance with this Annual Report, with the Detailed Development Plan (DDP), the Development Monitoring Plan (DMP) (both of which imply compliance with the Lease), and the Water Court Decree #W-3492 (leading to the Water Augmentation Plan (WAP)), a Requirements Compliance Matrix is presented on Table 1-1 showing where sections of these controlling documents are addressed in Volumes 1 and 2 of this Annual Report.

The following abbreviations appear in this report:

C.B. - for Cathedral Bluffs, and
C-b - for Colorado-b Oil Shale Federal Lease Tract.

TABLE 1-1

Requirements Compliance Matrix

Controlling Document	Document Section	Section Subject	Annual Report Volume I Section	Annual Report Volume II Section	Comments
DDP	Volume 1				
	I	General Information and Summary	1,2,4,7.13	1.1	
	II	Phase I - Mine Development			
	A.	Schedule & Summary	3,4	2.1	
	B.	Manpower	1,8		
	C.	Engineering Design & Procurement	3.2,4,5		
	D.	Mine Surface Facilities	1,3,4		
	E.	Mine Shaft Sinking	1,3,4,7.2		
	F.	Development Mine			
	G.	Utilities and Fuel	4		
	H.	Crushing and Conveying			
	I.	Alternate Mining Methods			
	J.	Access and Service Roads	4,7.10.2		
	K.	Dams		5.2.6, 5.3.6	
	L.	Coarse-ore Conveyor & Stockpile			
	M.	Shaft Dewatering, Treatment & Disposal	4	5.2.6,5.2.7,5.3.6,5.3.7	
III		Phase II - Plant Construction	5		
	A.	Summary	4		
	B.	Schedule & Manpower	3,8	2.1	
	C.	On-Tract Surface Facilities	4		
	D.	Off-Tract Facilities	4		
IV		Phase III & Phase IV			Not at this Phase of Development yet.
	A.	Summary - Phase III			" " " " " " "
	B.	Schedules and Manpower			" " " " " " "
	C.	Mine Operations			" " " " " " "
	D.	Crushing and Conveying			" " " " " " "
	E.	Retorting and Upgrading			" " " " " " "
	F.	Waste Disposal			" " " " " " "
	G.	Water Use			" " " " " " "
	H.	Electric Power Use			" " " " " " "

TABLE 1-1 (Continued)

Requirements Compliance Matrix

Controlling Document	Document Section		Section Subject	Annual Report Volume I Section	Annual Report Volume II Section	Comments
DDP		I	Utility Systems			Not at this Phase of Development yet.
		J	Pipelines			" " " " " " "
	V	K	Phase IV - Post Operations Environmental Control	7.12		" " " " " " "
			Plans	9		
		A.	Air Pollution Control	7.1,9.3.5	1.2.5,1.2.6,4.2.3,6.0	
		B.	Water Pollution Control	1, 7.2	1.2.3,4.2.2,5.1,5.2.6,5.3.6	
		C.	Noise Control	7.8,9.3.7	1.2.7, 4.2.4, 7.0	
		D.	Protection of Historic, Scientific & Aestnetic Values	7.7,9.3.11	1.2.11	
		E.	Fire Prevention and Control	1,7.9.3		
		F.	Health and Safety	1,7.9,9.3.12, 9.3.13	1.2.12, 1.2.13	
		G.	Overburden Management	6	1.2.9	
		H.	Processed - Shale Disposal	6		
		I.	Disposal of Other Wastes	4,6,7.5	1.2.13	
		J.	Fish and Wildlife Management	7.10,9.3.4,9.3.8	1.2.4,1.2.8,4.2.5,8.0	
		K.	Erosion Control and Surface Rehabilitation and Revegetation	6, 7.6, 9.3.9	1.2.9, 5.3.8	
		L.	SPCC Plan	7.4		
		M.	Off-Tract Corridors	7.11		
	VI		Environmental Monitoring	1	1.1	
		A.	Introduction	1	1	
		B.	Soils Survey and Productivity Assessment	1	5.3.8	
		C.	Surface Water	1, 4, 7.2	1.2.3,2.2,4.2.2,5.2.1,5.2.2,5.2.6,5.2.8,5.2.9,5.3.1,5.3.2,5.3.6,5.3.9	
		D.	Sub-surface Water	1, 4	1.2.3,2.2,4.2.2,5.2.3,5.2.4,5.2.5,5.2.8,5.2.9,5.3.2,5.3.4,5.3.5,5.3.9	
		E.	Meteorology and Air Quality	1, 7.1, 9.3.5, 9.3.6	1.2.5,1.2.6,4.2.3,6.0	
		F.	Biological	1,7.1, 9.3.5, 9.3.6, 7.10.3	1.2.4,1.2.8,1.2.9,4.2.5,8.0	
		G.	Noise	7.8, 9.3.7	1.2.7, 4.2.4	
DMP	1		Introduction	2, 9.1, 9.2	2.1	
	2		Milestones and Maps	9.2, 9.3	2.1	
	3		Photography	1, 9.3.1	1.2.1, 3.0, 4.2.1	
		.1	Surface	1	3.1	
		.2	Aerial	1, 4.3.10	3.2	
	4		Indicator Variables	1, 9.3.2, 9.3.10	1.2.2, 1.2.10, 4.0	
	5		Hydrology	1, 7.2, 9.3.3	1.2.3, 2.2, 4.2.2, 5.1	
		.2	Surface	1, 4, 7.2	5.2.1,5.2.2,5.2.8,5.2.9,5.3.1,5.3.2,5.3.9	
		.3	Sub-surface	1, 7.2	5.2.3,5.2.4,5.2.5,5.2.9,5.3.3,5.3.4,5.3.5,5.3.9	
		.4	Development	1,4	5.2.6,5.2.7,5.3.6,5.3.7	

TABLE 1-1 (Continued)

Requirements Compliance Matrix

Controlling Document	Document Section	Section Subject	Annual Report Volume I Section	Annual Report Volume II Section	Comments
DMP	.5	Systems Dependent	1,4		
	.6	Quality Assurance	1		
	6	Air Quality and Meteorology	1,7.1,9.3.5,9.3.6	1.2.5,1.2.6,4.2.3,6.0	
	.2	Ambient Air Quality	1,7.1	6.2	
	.3	Meteorlogy	1,7.1	6.3	
	.4	Development - Related	1,7.1		
	.5	Systems Dependent	1		
	7	Noise	1,7.8,9.3.7	1.2.7, 4.2.4, 7.0	
	8	Biology	1,9.3.8,9.3.9	1.2.4,1.2.8,1.2.9,4.2.5,8.0	
	.2	Big - Game Deer	1,9.3.8	1.2.8, 8.2	
	.3	Medium Sized Mammals	1 9.3.8	1.2.8, 8.3	
	.4	Small Mammals	1 9.3.8	8.4	
	.5	Avifauna	1 9.3.8	1.2.8, 8.5	
	.6	Aquatic	1,9.3.4	1.2.4, 8.6	
	.7	Terrestrial	1	8.7	
	.8	Threatened and Endangered	1	8.8	
	.9	Revegetation	1,6	8.9	
	.10	Systems Dependent	1	8.10	
	9	Items of Historic, Prehistoric or Scientific Interest	1,9.3.11	1.2.11, 9.0	
	10	Industrial Health and Safety	1,7.9,9.3.12,9.3.13	1.2.12, 1.2.13, 10.0	
	11	Subsidence Monitoring		11.0	
	12	Ecosystem Interrelationships	9.3.10	12.0	
	13	Data Management and Reporting	9.1,9.3.14,9.3.15	1.2.14,1.2.15,1.2.16,1.3	
Water Court Decree W-3493	7	Legal Description of Site	2,7.3	2.2	
	8	Sources of Water Supply		5.2.1,5.2.2,5.2.3,5.2.8,5.2.9	
	9,10,11	Dewatering and Augmentation	9.3.3	5.2.2,5.2.3,5.2.8,5.2.9	
	13	Assignment of Upper and Lower Aquifer		5.2.4,5.2.5,5.3.4,5.3.5	
	19	Evidence of Depletion Effects	9.3.3	5.2.1,5.2.2,5.2.3,5.2.4,5.2.8,5.2.9	
	24	Monitoring Program	7.2	1.2.3,2.2,4.2.2,5.1	
	25	Parameters		4.2.2,5.2.6,5.3.6	Exhibit A, wells, springs, seeps, streams, precip. sites. Exhibit B, Development Monitoring program.
	26	Timely Implementation Requirement		5.1	
	27	Following Cone of Depression		4.2.2,5.2.3,5.2.4,5.2.5	
	28	Monitoring Plan Modifications Provision		1.3,5.2.9,5.3.9,13.0	
	29	Cone of Depression Determination and Monitoring	9.3.3	4.2.2, 5.2.8	
	30	Water Replacement		5.2.8	
	31	Colony, Union, Agreement		5.2.8	

TABLE 1-1 (Continued)

Requirements Compliance Matrix

Controlling Document	Document Section	Section Subject	Annual Report Volume I Section	Annual Report Volume II Section	Comments
	32 - 38	Compensation for Depletions		5.2.8	
	39 - 46	Protection of Objectors Water Rights		5.2.8	
	47 - 50	Court Retention of Jurisdiction	7.3		
	51 - 59	Conclusions of Law	7.3		
	60 - 79	Judgement and Decree	7.3		
	62	Replacement Water		5.2.8	
	63	Compensations to Well Water Right		5.2.8	
	71	Replacement Water Quality			
	73	State Water Engineer - Conditions		5.2.2,5.2.4,5.2.9	
	75	Term Day Hearing Requirement			
	76	Augmentation Modification Provision		1.3	

2.0 DESCRIPTION OF PROJECT

2.1 Location

Federal Oil Shale Tract C-b is located in the Piceance Creek structural basin between the Colorado River on the south and the White River on the north. The basin is dominated by a large central plateau which represents more than 75 percent of the basin's land surface. The area represents a sparsely populated portion of the Rio Blanco County in northwestern Colorado. Terrain on the Tract consists primarily of undulating valleys and ridges trending in the northeasterly direction and draining into Piceance Creek. The northern edge of the Tract is approximately one-half mile south of Piceance Creek between Willow Creek and Stewart Gulch. Piceance Creek then flows northwesterly approximately 24 miles to its confluence with the White River. Irrigated-grassland ranching predominates along Piceance Creek. The towns nearest to the Tract are Meeker (48 miles), Rifle (45 miles), and Rangely (65 miles).

Elevations on the Tract vary from 6,400 feet in the lowest valley bottoms to 7,100 feet on the ridges to the southern edge of the Tract. The climate is semiarid with snow cover occurring variably from October to May. The climate supports sparse vegetation, with sagebrush and pinyon-juniper communities being dominant. Historically, the Tract has been used primarily for cattle grazing and providing winter range for mule deer. As part of a BLM range improvement program, approximately 45 percent of the Tract (primarily the flat ridgetops) was chained in 1967. The technique was intended to improve range production by removing sage and pinyon-juniper.

Location of the Tract relative to other existing and proposed oil shale projects in northwestern Colorado is shown on Figure 2-1.

2.2 Legal Description of the Leased Land

The Tract, as legally described in U.S. Department of the Interior Oil Shale Lease C-20341, consists of 5,093.9 acres, more or less, which is shown in Figure 2-2 and is located in Rio Blanco County, Colorado, as follows:

T3S, R96W, 6th P.M.

Section 5, W½, SE¼, and SW¼;
Section 6, lots 6 and 7, E½ SW¼, and E½;
Section 7, lots 1, 2, 3, and 4, E½ W½, and E½;
Section 8, W½ NE¼, NW¼, and S½;
Section 9, SW¼;
Section 16, NW¼, and W½ SW¼;
Section 17;
Section 18, lots 1, 2, 3, and 4, E½ W½, and E½;

T3S, R97W, 6th P.M.

Section 1, S½;
Section 2, SE¼;
Section 11,E½;
Section 12;
Section 13, N½;
Section 14, N½ NE¼.

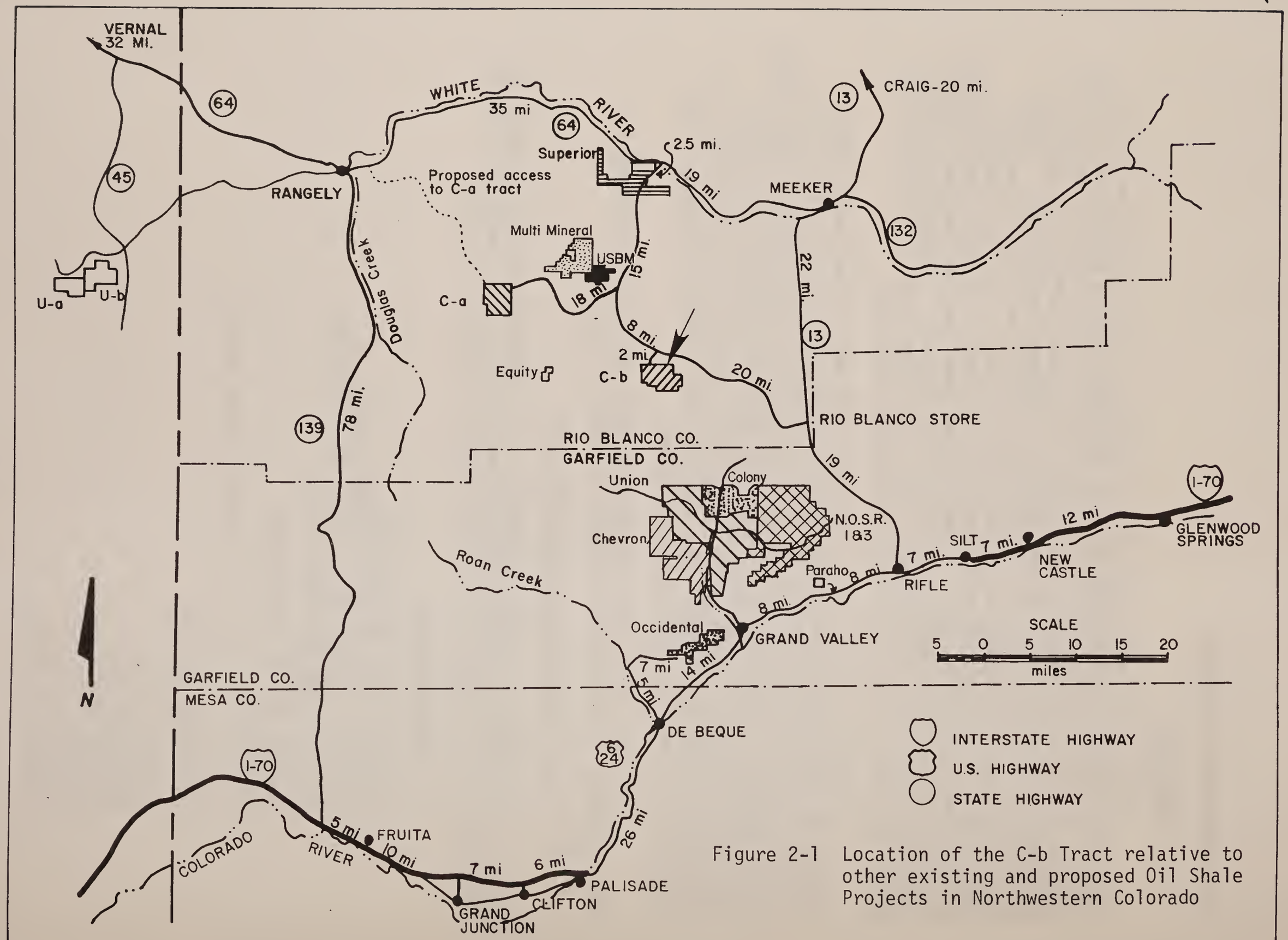

Figure 2-1 Location of the C-b Tract relative to other existing and proposed Oil Shale Projects in Northwestern Colorado

DRAWN BY VICKI SMITH
OCCIDENTAL OIL SHALE, INC.

2.3 Leasehold Status

The Lease requires that a Detailed Development Plan be developed prior to its third anniversary date. Such a plan was developed for surface retorting in February 1976. A modified plan to incorporate modified-in-situ retorting was prepared in February 1977. A further revision incorporating combined above-ground-retorting and modified-in-situ is currently being prepared this year. This Annual Report summarizing the operations conducted is a requirement under the Detailed Development Plan.

Furthermore, the Lease stipulates that operations be conducted in compliance with all Federal, State and local regulations and laws. Lease Environmental Stipulations are set forth to protect the environment; the environmental monitoring program called Development Monitoring is consistent with these stipulation requirements and forms part of the Detailed Development Plan. Volume 1 of this Annual Report summarizes the environmental program results and Volume 2 presents a discussion and analysis of this program.

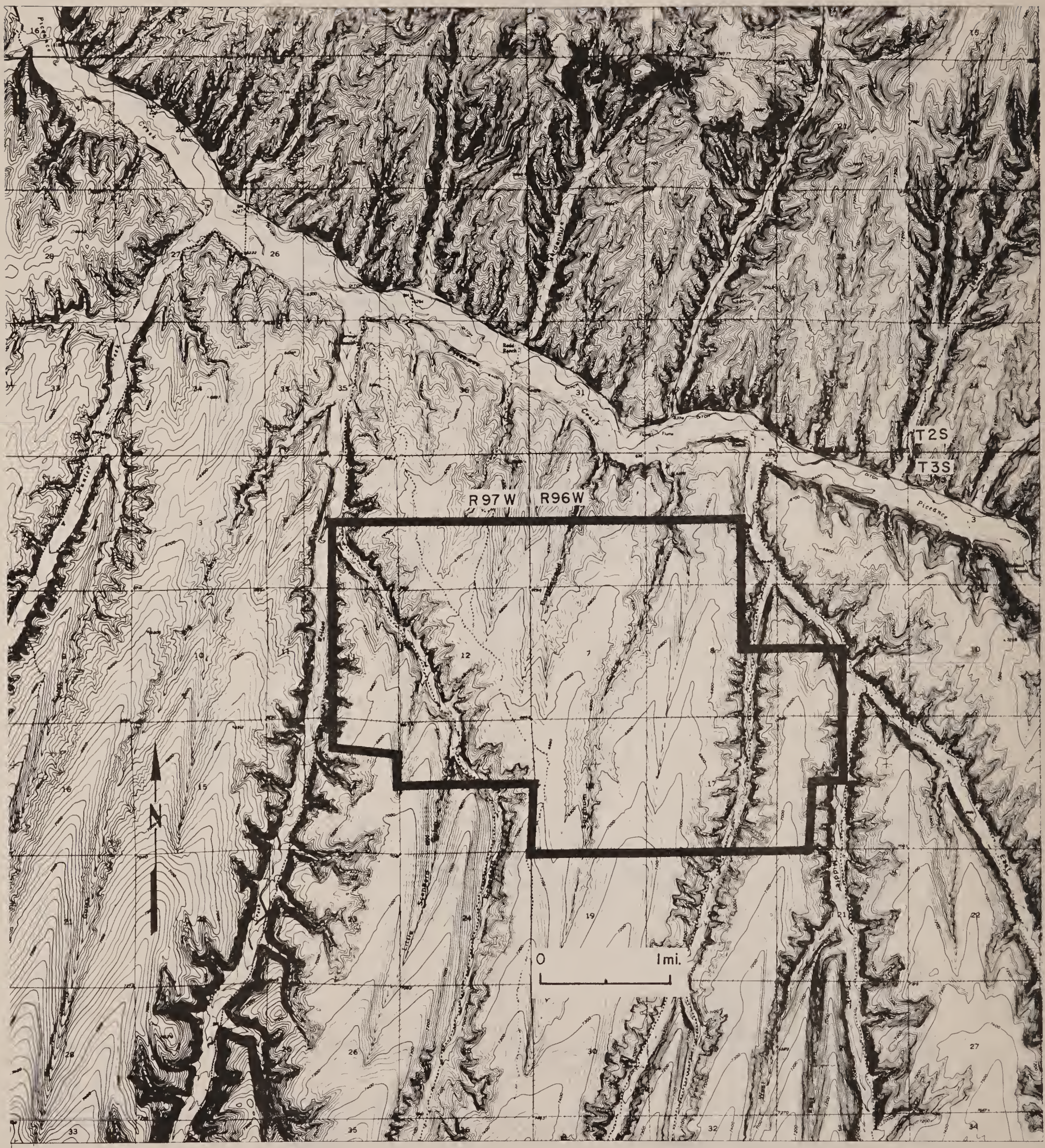

FIGURE 2.2 - LOCATION OF TRACT CB ACCORDING TO RANGE, TOWNSHIP AND SECTION

3.0 SCHEDULE AND COSTS

3.1 Schedule

3.1.1 "Milestone" Schedule

The "Milestone" schedule which has been approved by the OSO (and which appeared in last year's Annual Report) is given on Figure 3-1. The most recent update of this schedule through 1991, as yet unapproved by the OSO, is given on Table 3-1. Above-ground-retorting (AGR) activities are to be initiated in 1984, prior to those of modified-in-situ (MIS) which are to be initiated in 1985. Full production at 117,275 barrels per stream day (equivalent to 94,000 barrels per day averaged over a year) is scheduled for 1991. A revised DDP reflecting these new plans and schedule for development will be submitted in 1981.

A near-term update of projected construction activities through 1983 is shown in Figure 3-2. Sinking of the 15-foot diameter Ventilation/Escape (V/E) Shaft, the 29-foot Production Shaft and the 34-foot diameter Service Shaft is estimated to be completed in 1981. Outfitting of the headframes for all three shafts is to be initiated in 1981 with projected completion dates of 1981 for the V/E Shaft and 1982 for the Production and Service Shafts. Two MIS Off-gas Shafts are scheduled to be collared in December 1981 with shaft sinking completed by mid-1984.

3.1.2 Schedule vs. Actual Activities in 1980

Figure 3-3 shows how site-preparation and construction activities in 1977-1980 compared with the previously developed milestone schedule for this time span. Even though due diligence has been exercised some unavoidable schedule slippage from the original schedule has occurred.

The year 1980 represented the third full year of major construction development at the C-b Tract. This large scale effort, principally related to shaft sinking, involved many contractors. Project contractors and their area of responsibility are shown on Table 3-2. Shaft sinking was initiated on the V/E, Service and Production Shafts in January, February, and April of 1979, respectively, and continued throughout 1980.

3.2 Costs

Financial information for 1980 is presented in Table 3-3 for the following categories: field construction, engineering, operating costs, environmental, other programs, and general and administrative. Total costs compare with previous years as follows:

Year	Total Costs
1978	$41,045,000
1979	29,971,500
1980	50,512,500

TABLE 3-1

C.B. Project Milestone Development Schedule*

The major milestone schedule for MIS, with lightoff of the first retorts in mid-1985, and above ground retorting (AGR), is as follows:

- Release of detailed engineering in 1981
- Release of critical equipment procurement by late 1981
- AGR Trains #1 and 2 completed in mid-1984
- Mechanical completion of surface process facility (SPF) Train #1 in 1985
- Ignite first MIS Retort, late 1985
- Mechanical completion of SPF Train #2 in 1988
- AGR Trains #3, 4, 5, and 6 completed in early 1988
- Mechanical completion of SPF Train #3 in early 1989
- AGR Trains #7 and 8 completed in early 1989
- Mechanical completion of SPF Trains #4 and 5 in 1990

Full production scheduled to occur in 1991 with total MIS oil production rate of 68,975 barrels/maximum stream day (B/MSD). Full AGR production will occur in 1990 at a total production rate of approximately 48,300 B/MSD.

NOTE 1: AGR trains shown here are in units of 8500 T/D. Depending on the AGR units finally selected a single train may be of a larger size unit equivalent to 2 of the above. In that case there would only be four total units.

NOTE 2: SPF trains - either four or five units with equivalent maximum production capacity.

* 1981 Revised DDP plan, not yet approved by the OSO.

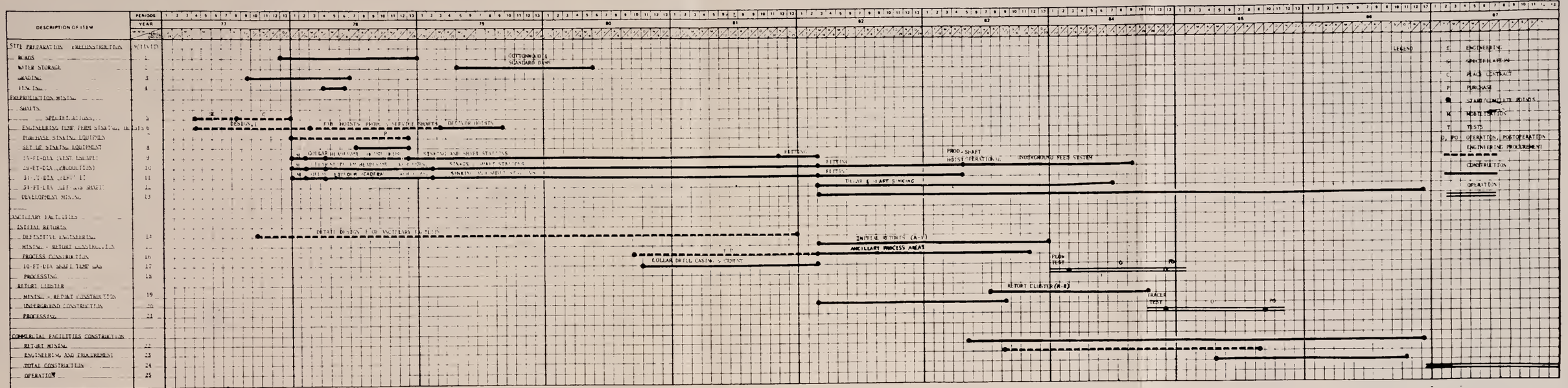

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FIGURE 3-1
OVERALL PROJECT GUIDE SCHEDULE

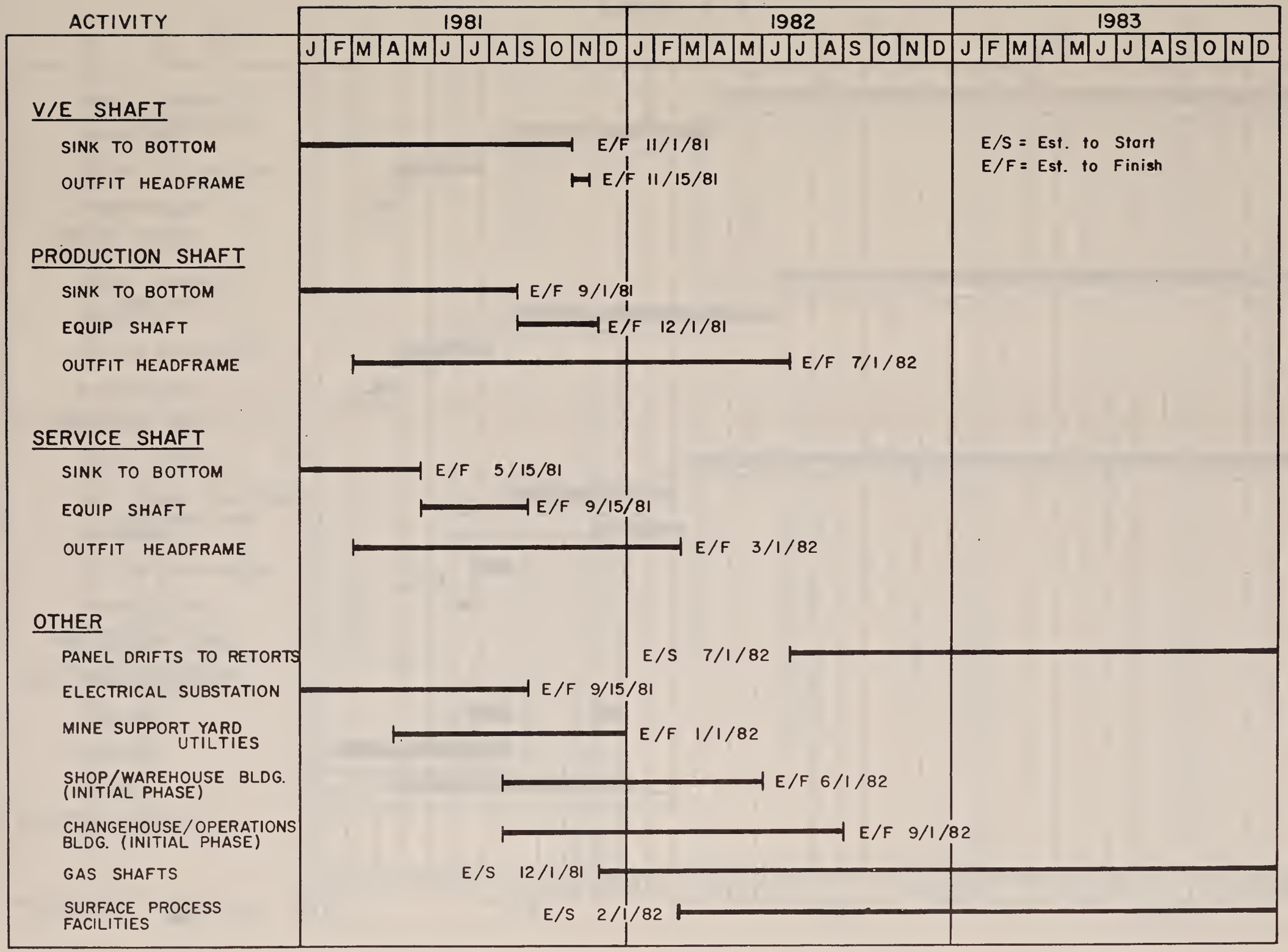


FIGURE 3-2
NEAR-TERM PROJECTED CB PROJECT
CONSTRUCTION ACTIVITIES (1981 REVISED DDP PLAN)

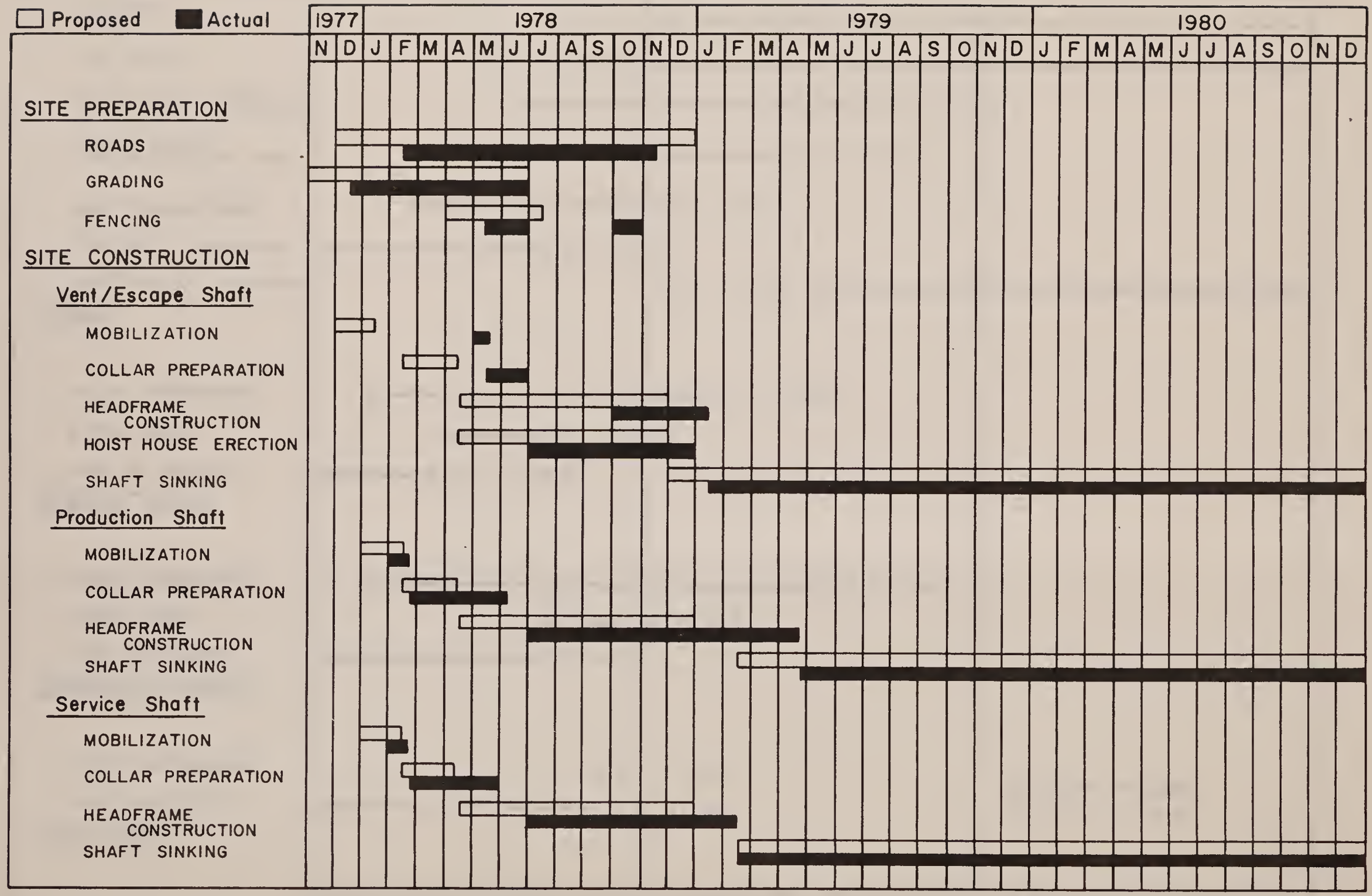


FIGURE 3-3
C-b PREPARATION AND CONSTRUCTION
ACTIVITIES IN 1977 – 1980

TABLE 3-2

1980 Major Contractors & Responsibilities

Gilbert Corporation	Sink Production, Service and V/E Shafts
Outoff Minerals Services	Operation and maintenance labor and minor construction
American Mobile Power Corporation	Flyte pump repair
A/R Industrial Constructors	Minor electrical construction and support for operation and maintenance
Dravo	Mine Development Engineering
Fluor	Processing studies
Colorado Ute	Off-site electrical transmission and sub-station design and procurement
Construction Surveys	Surveying
White and Sons Construction	Batch plant operation
Scott-Ortech	Mine gas monitoring
ECA, ECI, GSI	Hydrologic monitoring programs, well recompletion and subsurface reinjection planning
Stoecker & Keammerer	Wildlife and vegetation studies
Colorado River Water Control District	Surface-stream monitoring program
Tipton & Kalmbach	Irrigation system design
AeroVironment	Air Diffusion Modeling
American Drilling Company	Drilled injection well, recompletion of site wells.
C.R.C. Colorado Well Service, Inc.	Swabbing services
Logos Construction	Building construction, sewage plant, filter building and truck scales
N.L. McCullough, NL Industries	Logging services for recompletion program

The biggest single factors in this year's cost increase is (1) over $10,000,000 in increased costs associated with the headframes and shaft sinking, and (2) $4,000,000 increase in other programs (housing, community relations, land etc.).

Additional detail in the reclamation and revegetation area is provided in Chapter 6.

TABLE 3-3

1980 C.B. Expenditures (In Thousands)

FIELD CONSTRUCTION		
Managing Contractor	$ 411.1	
Shaft Sinking	22,637.8	
Headframe Costs	1,355.5	
Power Generating Costs	2,793.4	
Site Preparation	1,897.3	
Dewatering, Irrigation & Water Treatment	430.1	
Mine Services	19.1	
		$29,544.3
ENGINEERING COSTS		
Construction Support	2,856.6	
Technical Support	3,044.7	
		5,901.3
OPERATING COSTS		
Tract Operations and Maintenance		1,587.7
ENVIRONMENTAL		
Monitoring:		
Air	93.1	
Water	855.4	
Geology	11.7	
Biology	103.1	
Photography	22.2	
Ecosystem Interrelationships	1.1	
Reports	231.4	
Permits	42.1	
Water Resource Development	69.3	
Reclamation	37.0	
		1,466.4
OTHER PROGRAMS		
Housing	277.8	
Community Relations	556.0	
Busing	707.5	
Insurance and Property Taxes	625.2	
Land	849.6	
Other	997.6	
		4,013.7
GENERAL AND ADMINISTRATIVE		
Staff Costs	5,854.5	
Employment Expenses	975.1	
Legal and Professional	193.5	
Office	519.7	
Other Expense	156.3	
Overhead	300.0	
		7,999.1
TOTAL PROJECT		$50,512.5

4.0 DEVELOPMENT ACTIVITIES

This chapter describes 1980 development activities relative to on-tract facilities in Section 4.1, off-tract facilities in Section 4.2, access/service and support in Section 4.3 and mining in Section 4.4.

4.1 On-Tract Facilities Description

4.1.1 General Arrangement

As in 1979, construction activities in 1980 consisted primarily of shaft sinking. Also in 1980 construction of 15-20 new supporting surface facilities has been accomplished.

In September, the entire tract was overflown and photographed for aerial mapping. Photographs were taken from two elevations to provide maps of the entire tract on a 5-foot contour interval, 1:2400 scale. Areas to be affected by planned construction in the near future will be mapped on a scale of 1:1200 with a 2-foot contour interval. Mapping was completed in early February 1981. This task resulted in the following map set, with those so indicated appearing inside the back cover of this report in reduced scales:

Figure 4-1 - 1:7200 Topographic Map
4-2 - 1:7200 Aerial Mosaic
1:2400 Topographic Map. . Area 1 (See Figure 4-3 for location of all 12 areas)
Area 2
Area 3
4-3 - . . . . . Area 4
Area 5
Area 6
4-4 - . . . . . Area 7
4-5 - . . . . . Area 8
Area 9
Area 10
Area 11
Area 12

A general plot plan of the existing facilities has been prepared from these maps. For reference, 1979's plot plan is shown on Figure 4-6a; the updates and plan details are presented on Figure 4-6b. The key to the facilities' numbers is given on Table 4-1.

A near-tract facilities inventory format has been initiated as indicated on Table 4-2; it is further detailed on Table 4-3 to show all facilities completed on-tract in 1980.

Most activities occurred near the mine support area for which aerial views are shown on Figures 4-7a and 4-7b. The view looking northward (Figure 4-7b) is repeated with a side-by-side portion of a tract map identifying the facilities on Figure 4-8, utilizing the same facility numbers as on Table

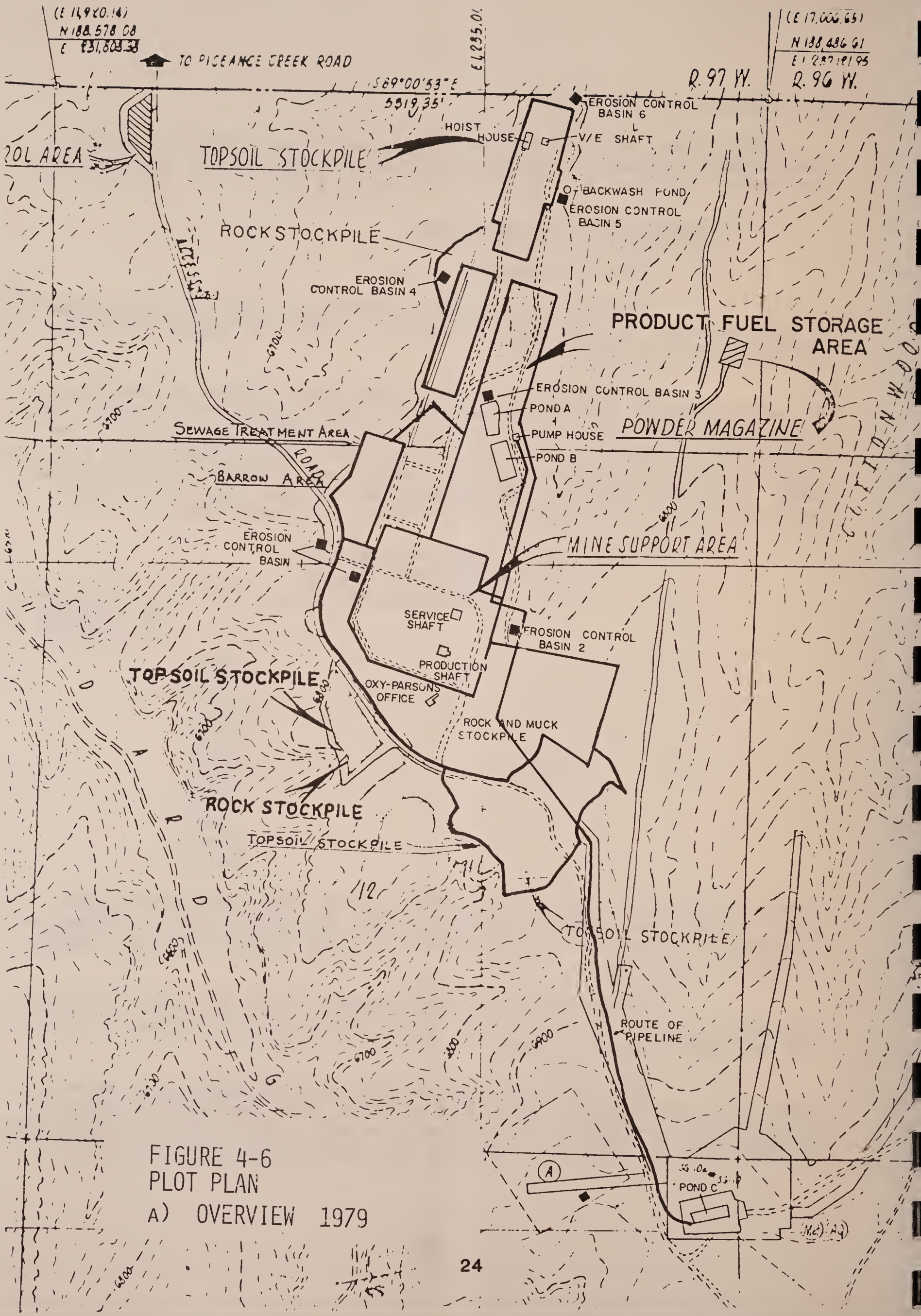


FIGURE 4-6
PLOT PLAN
A) OVERVIEW 1979

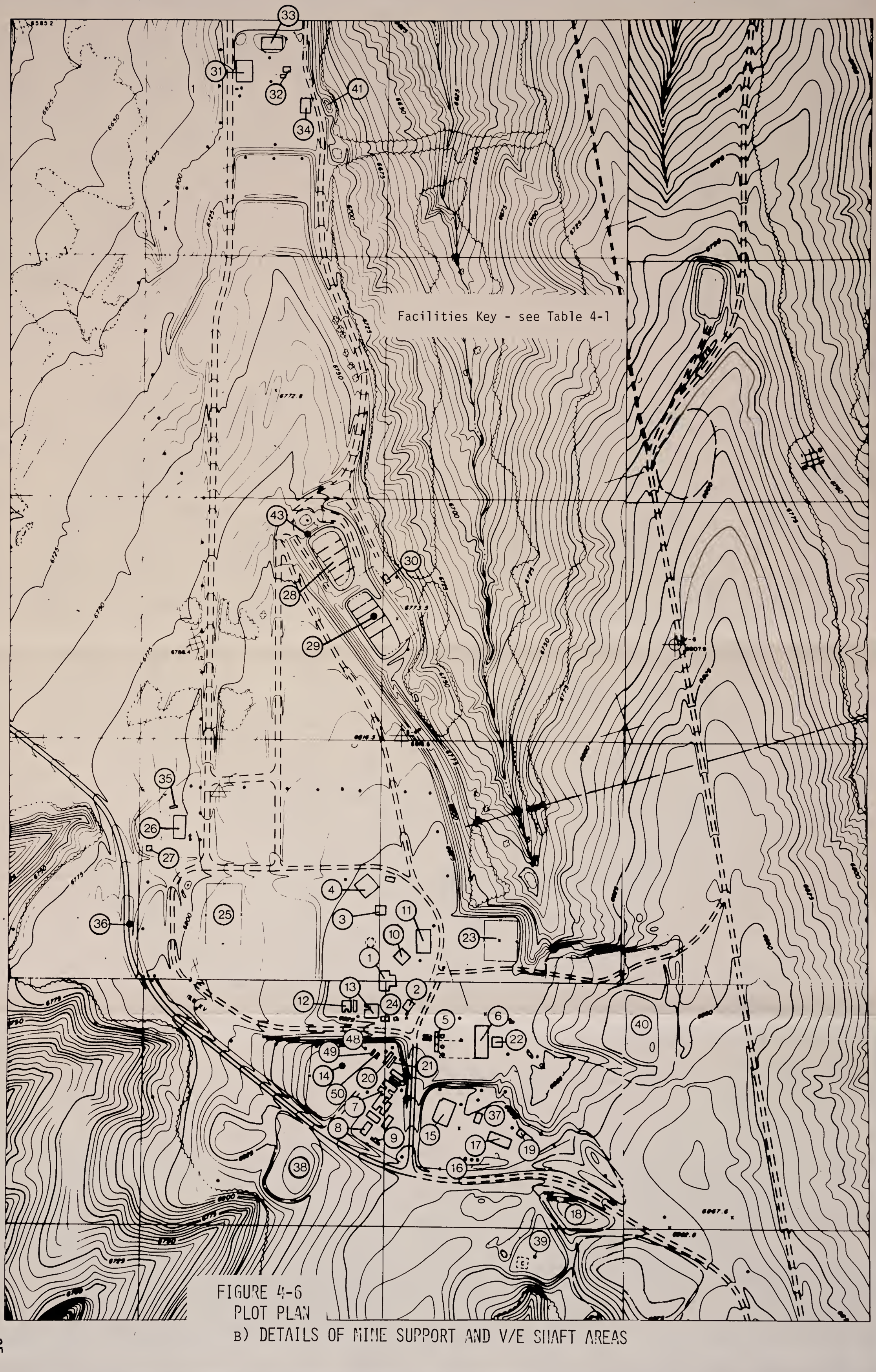


FIGURE 4-6
PLOT PLAN
B) DETAILS OF MINE SUPPORT AND V/E SHAFT AREAS

TABLE 4-1

Facilities List*

1. Production Headframe
2. Production Hoist
3. Service Headframe
4. Service Hoist
5. Cement Batch Plant
6. Cement Batch Plant Aggregate Storage
7. (H Lazy H) Office Complex (4 Trailers)
8. Emergency Vehicle Building
9. First Aid Trailer
10. Production Hoist
11. Gilbert Shop
12. Gilbert Offices
13. Dry
14. Parking Area
15. Warehouse
16. Fuel Storage Facilities
17. CGE Warehouse
18. Topsoil Storage Area
19. Fabrication Shop
20. Office Trailer
21. Office Trailer
22. General Service Contract Offices
23. Colo. Ute Switchyard
24. Winch
25. CGE Storage Area
26. Generator Building
27. Pump Repair Building
28. Pond A
29. Pond B
30. Pumphouse
31. V/E Hoist House
32. V/E Headframe
33. Gilbert Shop
34. Gilbert Dry
35. Fuel Storage
36. Paved Main Access Road
37. Generator
38. Rebar Storage Yard
39. Environmental Storage Building
40. Shale Disposal Area
41. Backwash Pit
42. Recreation Trailers
43. Acid Injection Building
44. Guard House
45. Truck Scale
46. Heliport
47. L'eau Claire Filter
48. Brass Shack
49. Hydro/Air Lab
50. Soils Lab

* See Figure 4-6b

TABLE 4-2

Near-Tract Facilities Inventory Format (Geographic Data Base)

Computer Code	Facility Class	Facility Type or Use
	Environmental Stations	
AA__ to AD__*		Air Monitoring
BA__ to BT__		Biological Monitoring
NA__ , NB__		Noise Monitoring
PA__		Photographic Monitoring
WA__ to WZ__		Water Monitoring
	Structures	
FA__ to FD__		Offices, Buildings, Labs
FE__ to FG__		Processing Facilities, Other
FM__ to FN__		Processing Facilities, MIS
FO__ to FP__		Processing Facilities, AG Shale
FR__ to FS__		Processing Facilities, AG Retorting
FW__ to FX__		Warehouses, Storage
FY__ to FZ__		Other
	Materials Storage	
MN__		Non-Hazardous
MH__		Hazardous
MO__ to MZ__		Other Categories
	Areal Sources	
CA__ to CZ__		Ground Cover (Habitat)
DA__ to DZ__		Disturbed Acreage
IA__ to IZ__		Impoundments/Ponds/Reservoirs
RA__ to RZ__		Revegetation/Reclaimed Acreage
SP__		Shale Piles, Processed
SR__		Shale Piles, Raw
TA__ to TZ__		Topsoil Piles
	"Line" Sources	
RU__ to RZ__		Road Segment, Unpaved
RP__ to RS__		Road Segment, Paved
LW__ to LX__		Lines, Water
LO__ to LM__		Lines, Oil
LN__		Lines, Natural Gas
LT__ to LV__		Lines, Telephone
LA__ to LD__		Lines, Power
YA__ to YZ__		Stream Segment
XA__ to XZ__		Transects

* 4 digit code

TABLE 4-3

On-Tract Facilities Added in 1980

Facility Class	Facility Type	Facility No.*	Description/Use	Approximate Size (ft x ft)	Colorado Coordinates (ft) N	Colorado Coordinates (ft) E	Shown on Figure	Completion Date Mo	Completion Date Yr	Removal Date Mo	Removal Date Yr
Structures	Offices	7	Office Trailer number 1	24 x 70	183,840	1,234,560	4-5	6	80		
			Office Trailer number 2	24 x 70				6	80		
			Office Trailer number 3	24 x 60				6	80		
			Office Trailer number 4	24 x 60				7	80		
			Modular offices for project staff								
		42	Heliport/Recreation Trailer - Public Relations and other presentations and lectures	14 x 60	187,350	1,232,550	4-3	5	80		
	Laboratories	49	Laboratory Trailer - Air-quality and hydrological instrument maintenance and repair	14 x 60	184,020	1,234,560	4-6b	10	80		
		50	Soils Laboratory Trailer - Soils analysis	14 x 60	184,000	1,234,580	4-6b	10	80		
	Shops	19	Pipe Fabrication Shop - Storage and fabrication of pipe	30 x 60	183,530	1,235,050	4-6b	12	80		
	Buildings	43	Acid Injection - Used at Pond A to reduce high pH of mine water	10 x 15	186,150	1,234,950	4-3	10	80		
		45	Truck Scale - Houses the truck weighing scale	16 x 70	188,250	1,232,440	4-3	11	80		
		6	Batch Plant Aggregate - Aggegate storage for cement batch plant	14 x 30	183,940	1,235,000	4-6b	12	80		
		47	L'eau Claire Filter - Filtration of solids from Pond C waters prior to reinjection	40 x 50	180,200	1,236,780	4-25a	12	80		
		39	Environmental Storage - Storage of miscellaneous environmental equipment	40 x 50	183,040	1,234,950	4-6b	12	80		
	Warehouses	17	Warehouse (Canadian General Electric Storage) - Storage for hoist-related equipment	50 x 100	183,510	1,234,950	4-6b	6	80		
	Other	46	Heliport - Landing area for project helicopter	100 x 250	187,330	1,232,420	4-3	5	80		
		45	Truck Scale - Obtain truck weights near Tract entrance	120,000 lbs	188,250	1,232,440	4-3	11	80		
		-	Guard Rails - Safety-guards along major roadsides	4,500 ft	-	-	4-3	11	80		

* See also Table 4-1

a) SOUTH VIEW

b) NORTH VIEW

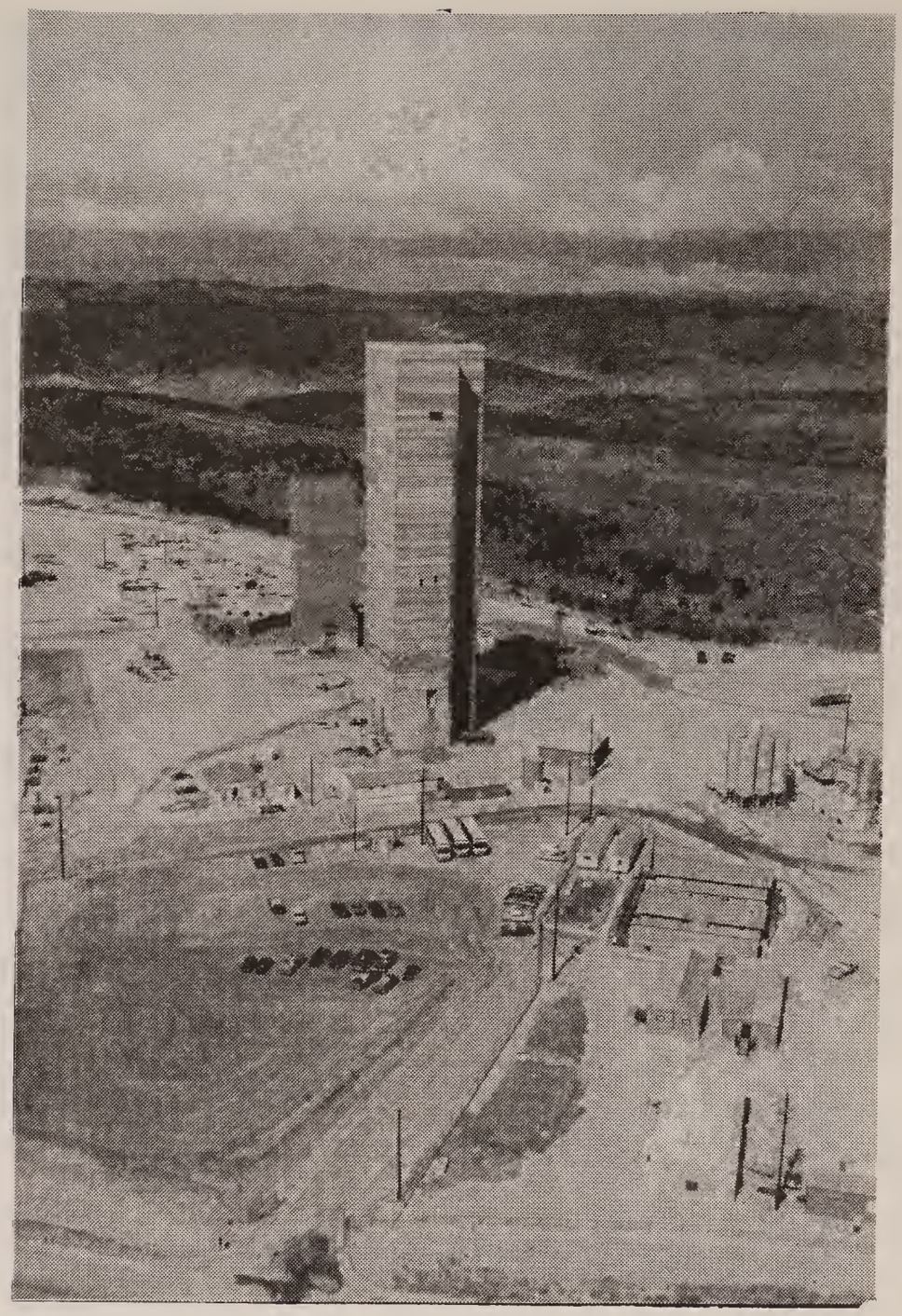


Figure 4-7 Aerial Views of the Mine Support Area (April 1980)

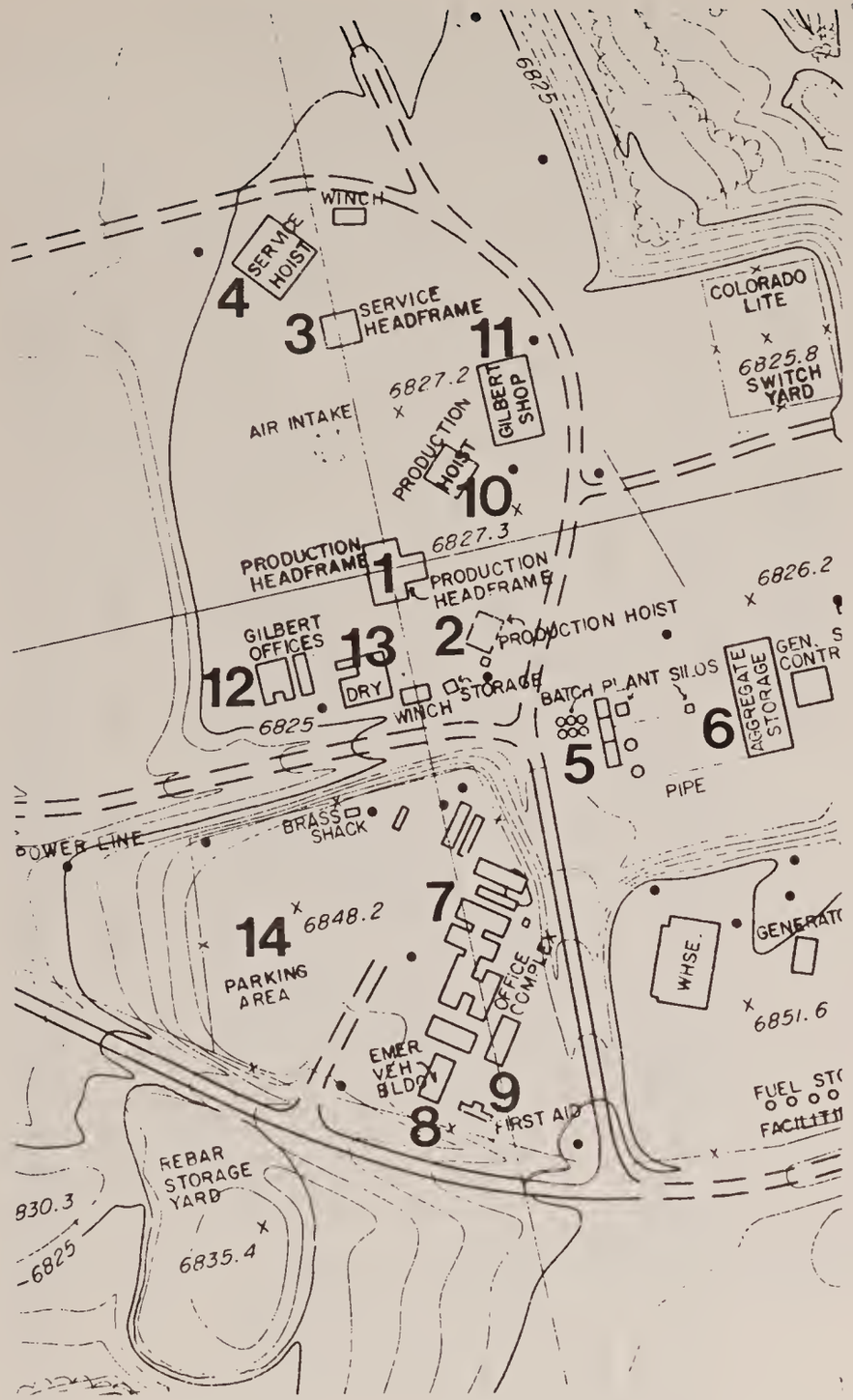


Figure 4-8 Aerial Views of the Mine Support Area - Looking North (April 1980) Including Facility Identification

4-1. That for a southerly view is repeated on Figure 4-9. Aerial views of the V/E shaft area in April and October, 1980 are shown on Figures 4-10a and -10b, respectively. The southward view of April 1980 is repeated with an identifying map on Figure 4-11.

Disturbed, reclaimed, and revegetated acreages are presented in Chapter 6.

4.1.2 Production Shaft Headframe

Construction of the 29-foot diameter Production Shaft was begun in February 1978 when it was "collared in" to approximately 70-foot depth by conventional excavation methods. The 313 foot headframe was "slipformed" in just 26 days during September and early October 1978. Slipforming is a method of continuous construction in which the form is slipped or jacked-up as the concrete is poured in place. The rebar is placed ahead of the advancing form. Steel beams and floors were installed and collar floors completed; the roof and lower power floor beams were then set. The sinking and galloway hoists were installed in 1978. Both are housed in temporary metal buildings which were erected near the shaft. They are used during shaft-sinking activities only. Mechanical and electrical facilities were completed in 1979. The Production Shaft will serve as the main "mined-rock" hoisting facility during commercial operation. Its location is shown on Figures 4-6b, 4-7b, and 4-8. Headframe cross-sectional schematics were presented on Figure 4-6 of the 1979 Annual Report.

Inasmuch as initiation of construction on the permanent hoists is to be undertaken in 1981, a 60-ton bridge crane has been procured; components of this crane are shown on Figure 4-12. A temporary warehouse to house these hoists is shown on Figure 4-13.

4.1.3 Service Shaft Headframe

Construction of the 34-foot diameter Service Shaft was commenced in February, 1978. The collar and headframe foundations were completed at a depth of 65 feet in May. The slipforming of the headframe tower took place in a 10-day period during August, 1978 with the installation of steel beams and floors in progress at year end. The manloading and collar floor was completed with beams set in the roof, upper power floor, lower power floor and dump chute. The dump chute and collar door were installed. The sinking and service hoists were then installed and a metal building erected to enclose them. The shaft-sinking mechanical and electrical facilities were completed in 1979. The Service Shaft will be used for both men and equipment hoisting and as a fresh-air ventilation intake. The air inlet or "air tunnel" to the Service Shaft was completed during August, 1978; it enters the Service Shaft some 100 feet below grade. Location of the Service Shaft headframe is shown on Figures 4-6b, 4-7b, and 4-8. Cross-sections were illustrated on Figure 4-9 of the 1979 Annual Report.

4.1.4 Ventilation/Escape Shaft Headframe

Construction of the 15-foot diameter Ventilation/Escape (V/E)

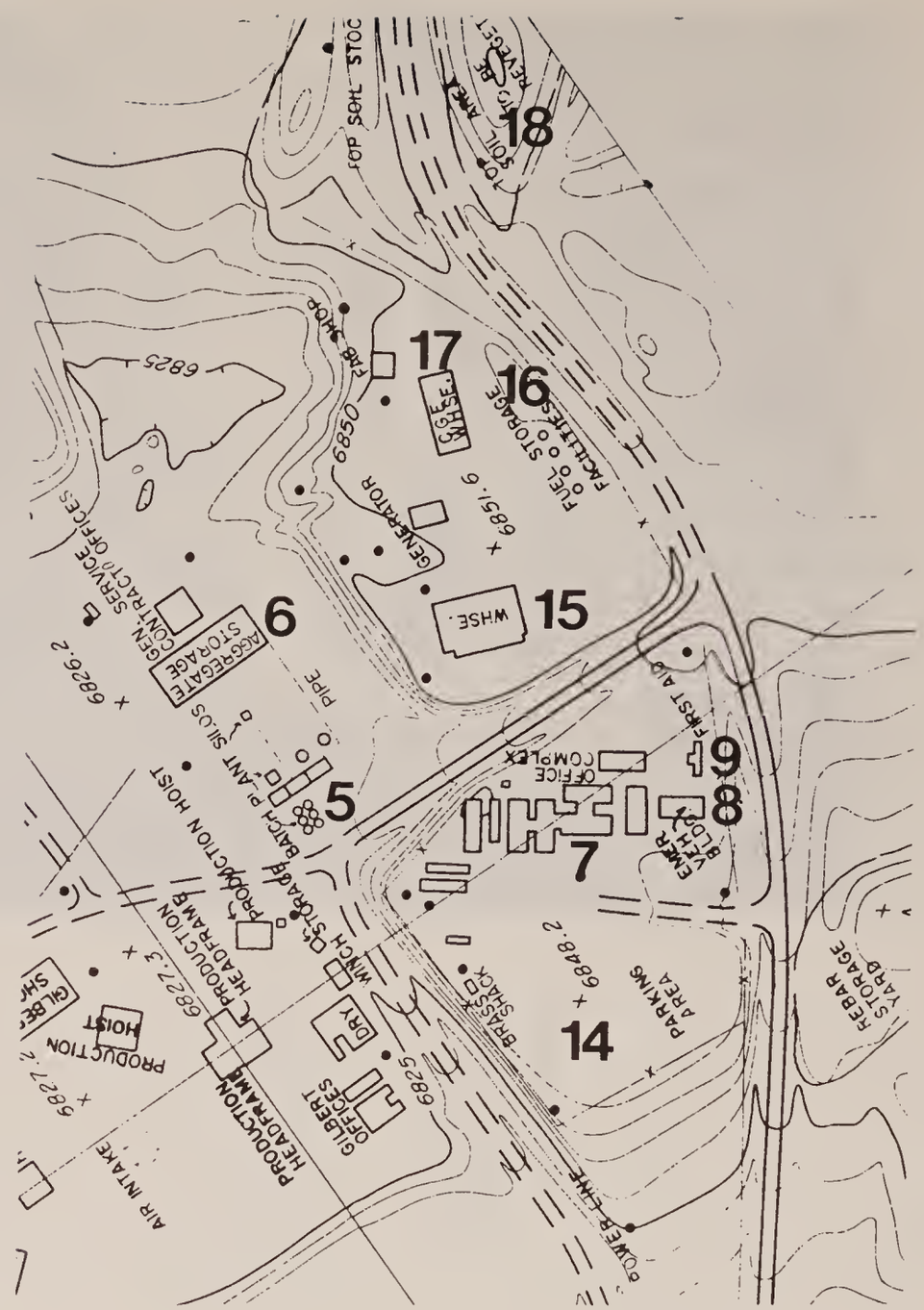


Figure 4-9 Aerial Views of the Mine Support Area - Looking South (April 1980) Including Facility Identification

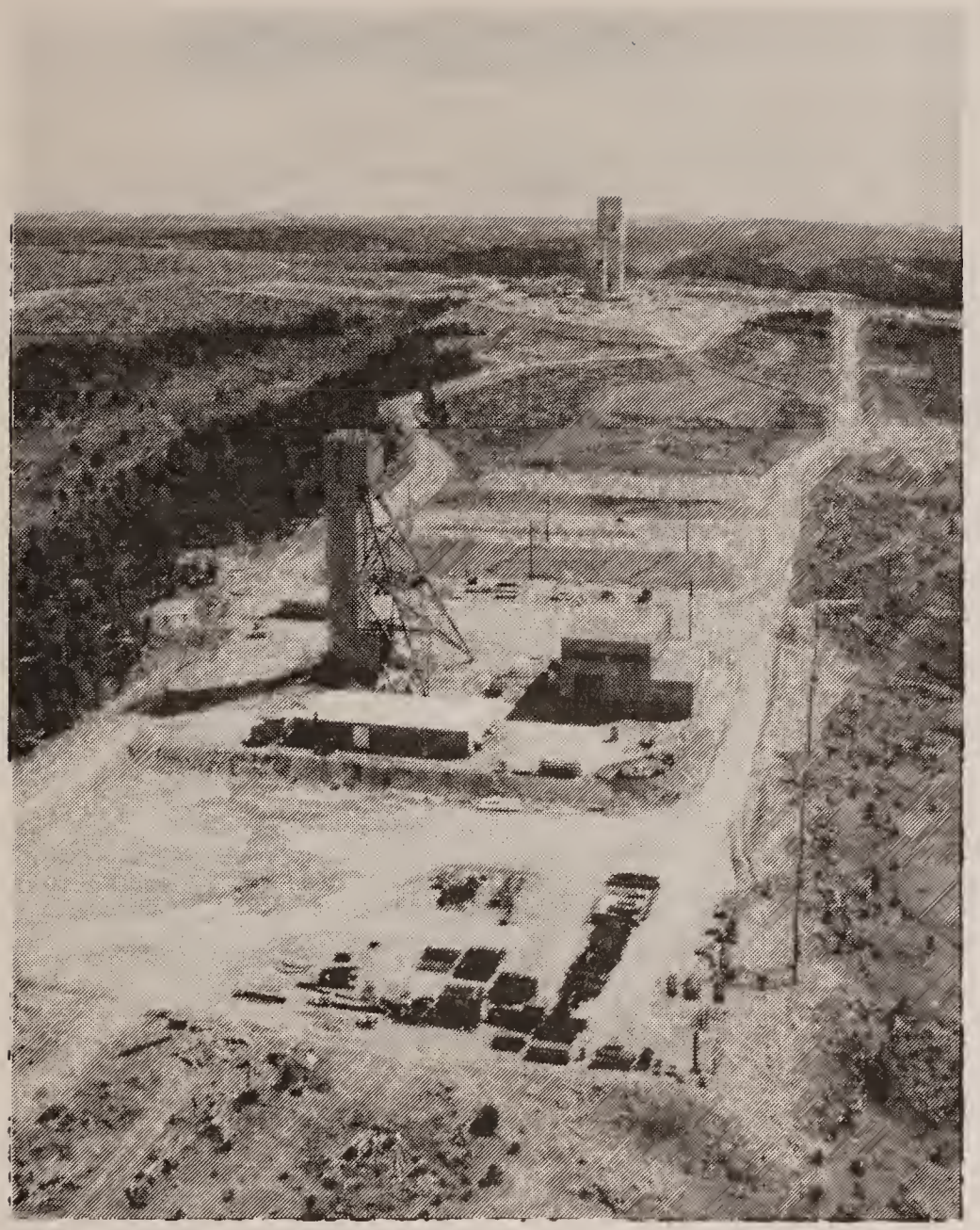
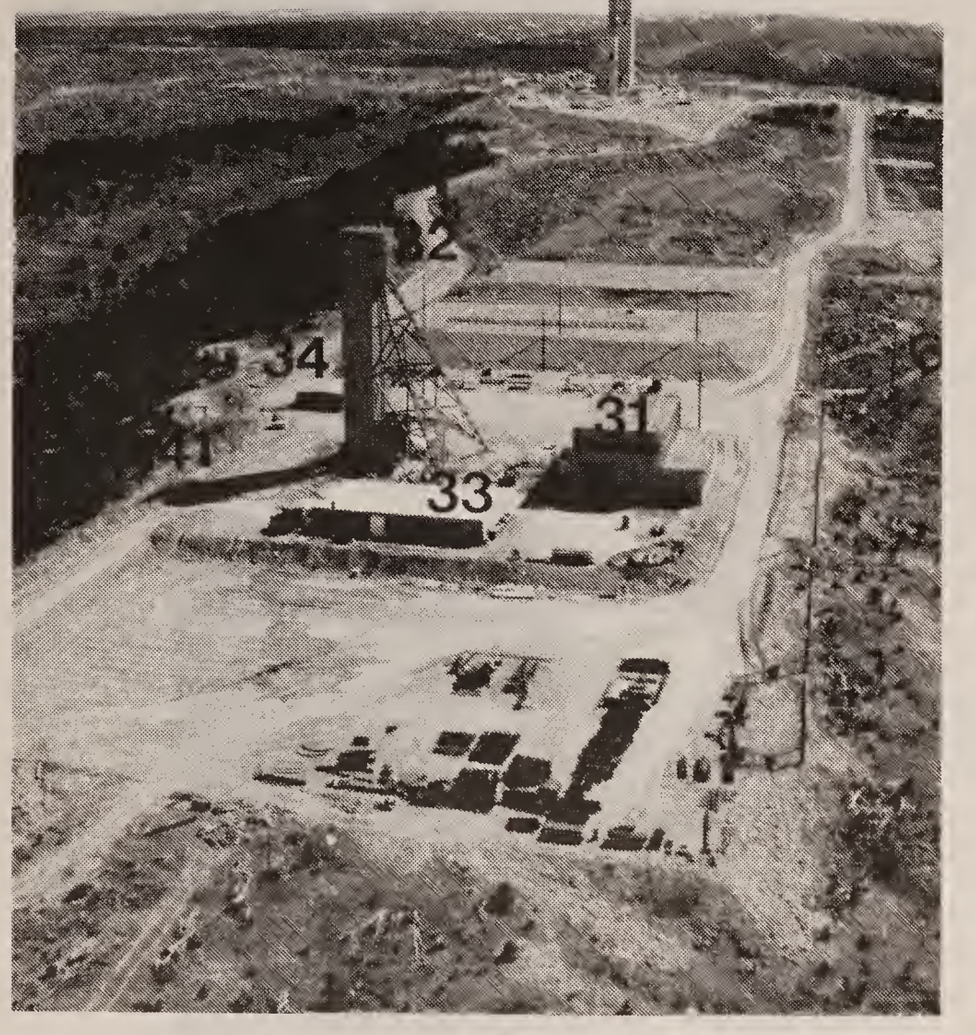


Figure 4-10

Aerial View of
V/E Shaft Area

a) April 1980

b) October 1980



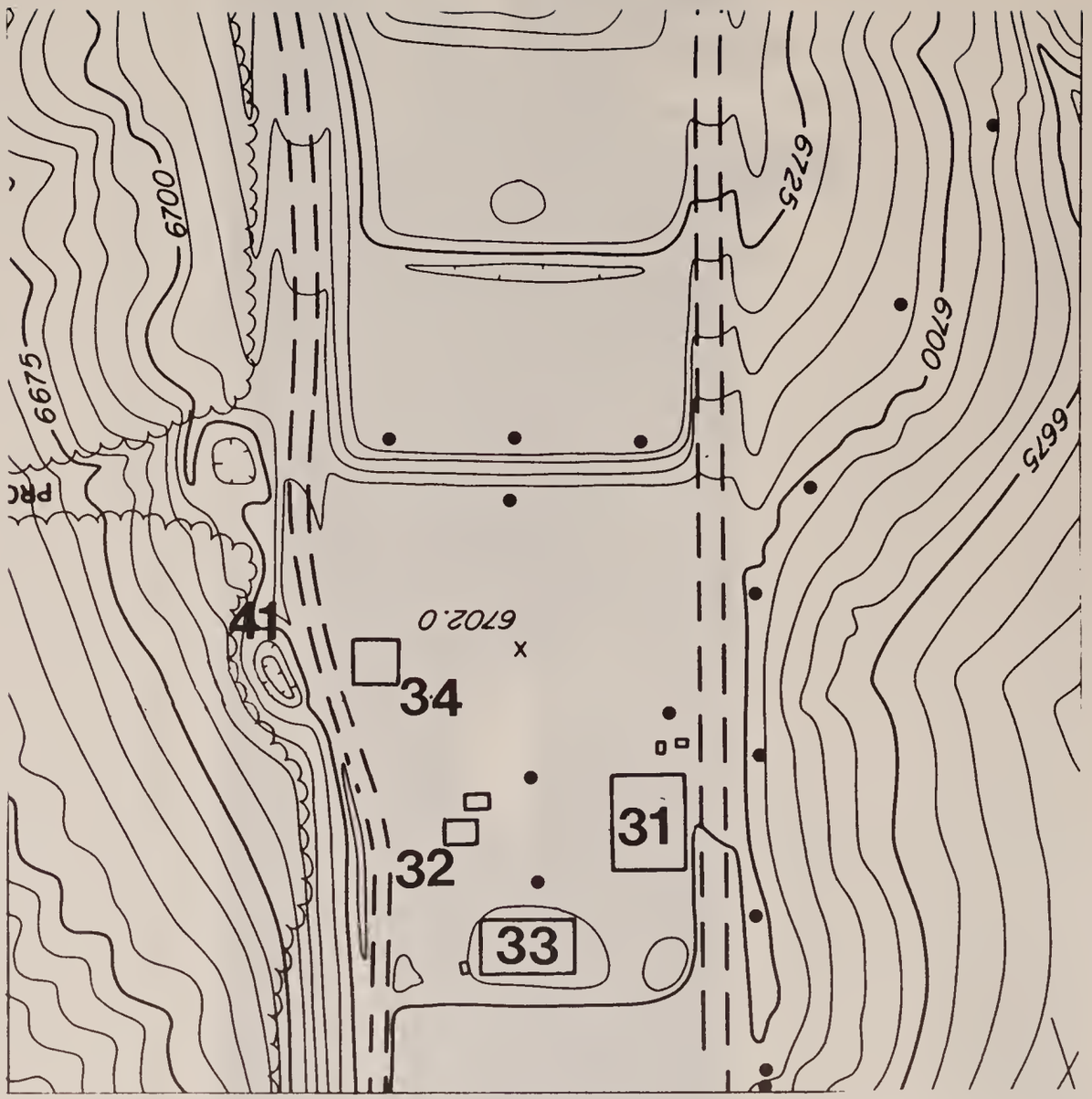


Figure 4-11 Aerial View of the V/E Shaft - Looking South (April 1980) Including Facility Identification

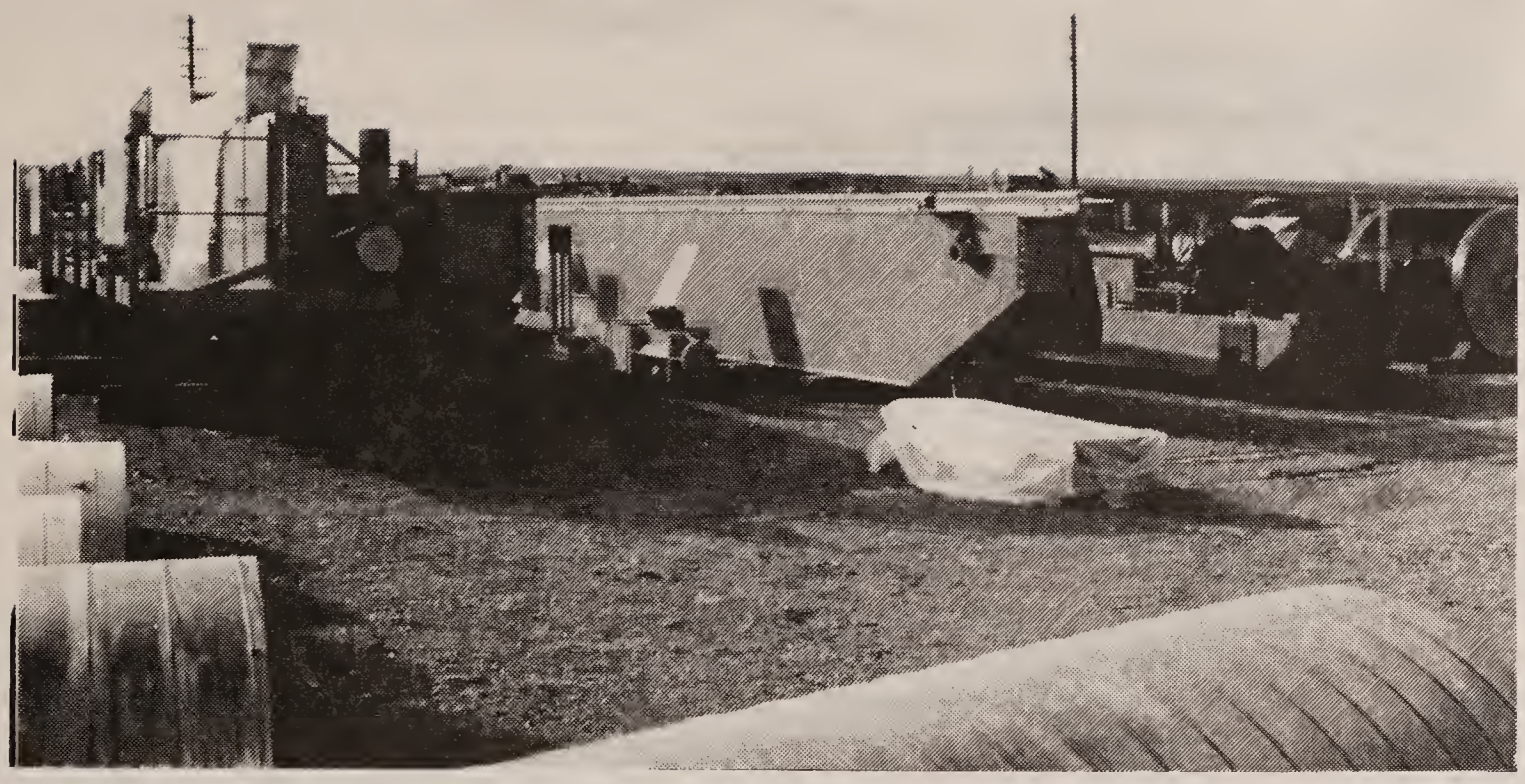


Figure 4-12 Components of the 60-Ton Crane to be used to Raise the Production Shaft Hoists (July 1980)

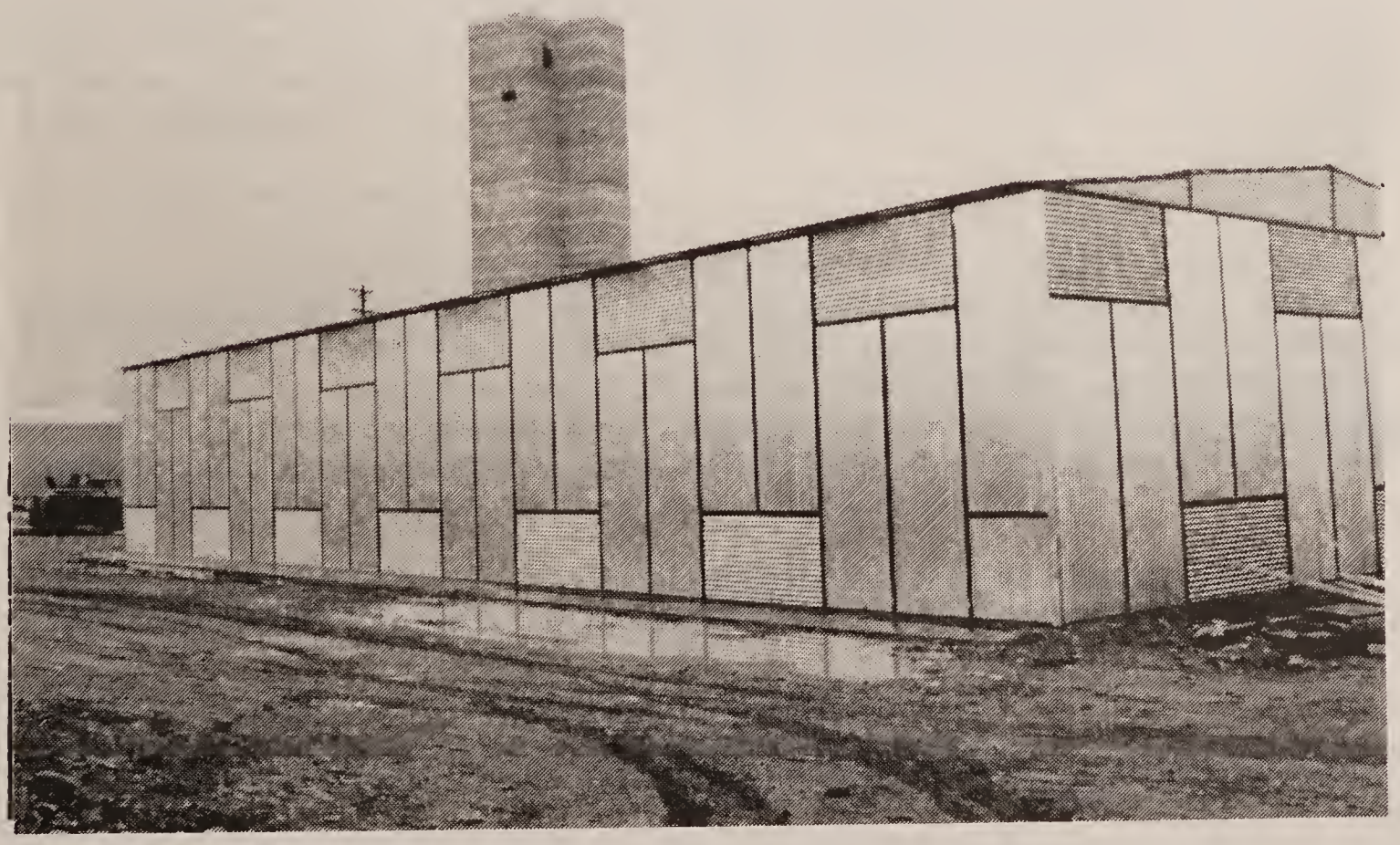


Figure 4-13 Temporary Warehouse for Production/Service Hoists (July 1980)

Shaft commenced in May, 1978; the collar and headframe foundation was completed that June. The structural steel headframe has been erected and the siding and dump-chute installation were completed. A metal building to house the shaft sinker's shop and dry room was erected in 1978.

Construction of the V/E Shaft hoist house was begun during July, 1978; the building itself was completed in December. Installations of mechanical/electrical facilities were completed in 1979. Location of the V/E Shaft headframe is shown on Figures 4-6b, 4-10 and 4-11. A photograph of the emergency generator and canopy installation as completed in December 1980 are shown on Figure 4-14.

4.1.5 Electric Power and Switching Facilities

Primary power for the site is provided by nine 1000 KW, 4160 V, natural-gas-powered generators. Seven units were installed in 1978 and 1979 with two additional units being installed in 1980. Distribution is by 13.8 KV overhead poleline to the shafts, batch plant, warehouse and office areas. Generators are placed on line as requirements demand with at least one unit in stand-by mode at all times. In addition, there are four 250 KW, 440 V diesel-driven generators to provide emergency power to the batch plant and office/warehouse complex. One additional generator is located at the V/E Shaft to provide emergency 480 V power for the shaft ventilation system (Figure 4-14). Power for environmental monitoring stations, heliport, sewage treatment plant and security gate is furnished at a loading of 7.2 KV by White River Electric Company.

Site preparation for the substation and switchyard for the 138 KV Meeker-to-Tract powerline was initiated in July 1980 (Figure 4-15) and progress by October is seen in Figure 4-16; the switchyard is adjacent to the Production and Service Shafts. High voltage switching equipment being installed in the electrical switchyard (December 1980) is shown on Figure 4-17. The powerline from Meeker is scheduled for construction during the summer of 1981.

4.1.6 Water Wells

Deep well pumps were installed in Wells 33X-1 and 32X-12 in 1979 to provide water for shaft requirements and shower facilities. Construction was completed in the first quarter of 1980 and the system was implemented. Usage of these wells continued until it was recognized that continued usage affected their utility as ground-water monitoring wells. The deep well pumps were removed from these holes and they reverted to monitoring well use. Well 33X-1 was permanently plugged with concrete in November 1980.

Water for the batch plant operations and shower facilities is hauled via truck from the well on Piceance Creek (designated 24X25).

4.1.7 Office, Warehouse, and Shop Facilities

Buildings which were completed in 1980 are listed in Table 4-3 along with descriptions as to use, size and location. All buildings, with the exception of the fabrication shop and the batch-plant aggregate-storage enclosure are pre-engineered, pre-fabricated structural steel buildings, or of

Figure 4-14 V/E Shaft Emergency Generator and Canopy Installation (December 1980)

Figure 4-15 Site Preparation for the Power Substation (July 1980)

Figure 4-16
Erecting Steel at the Electrical Switchyard (October 1980)

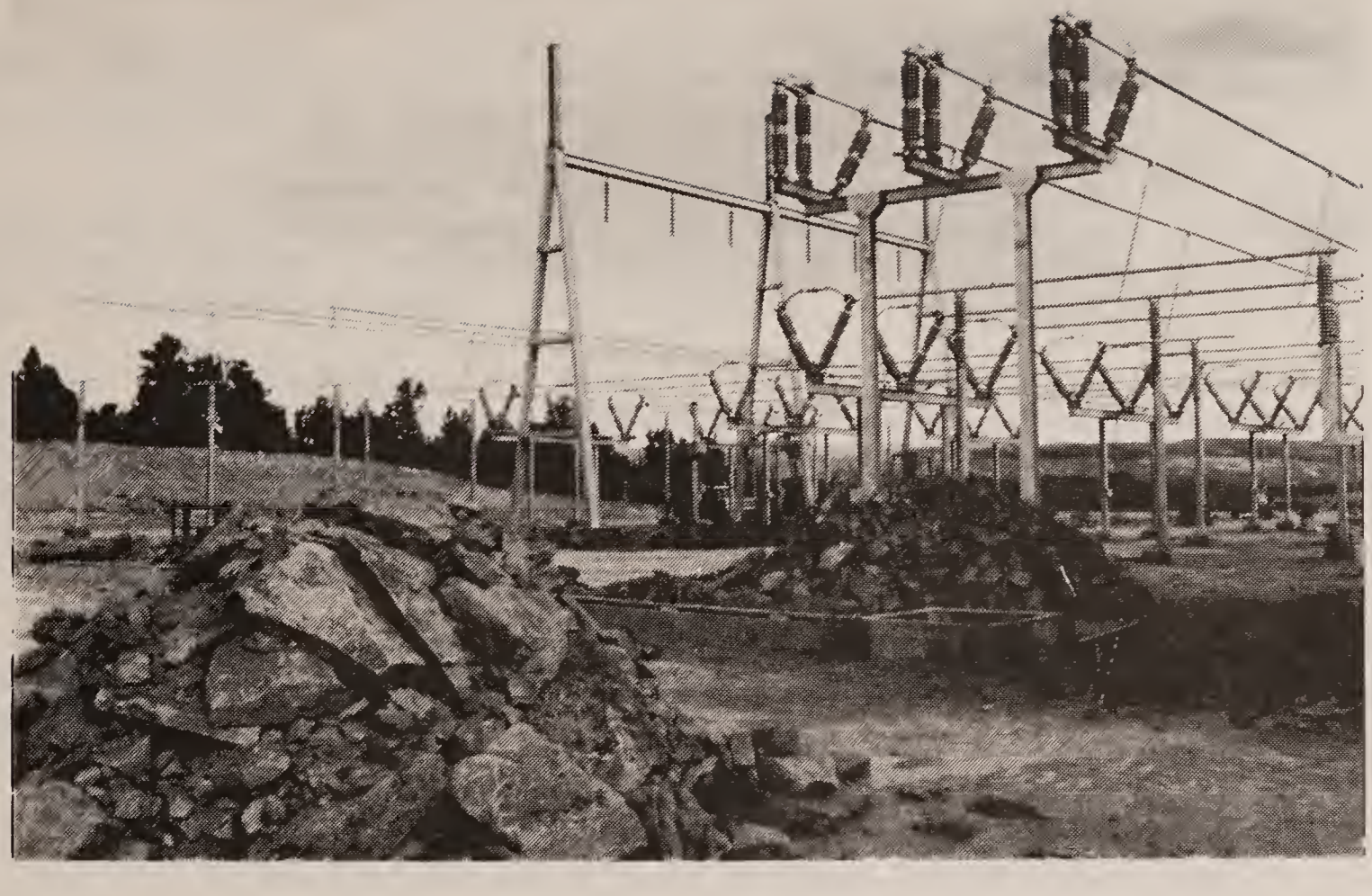
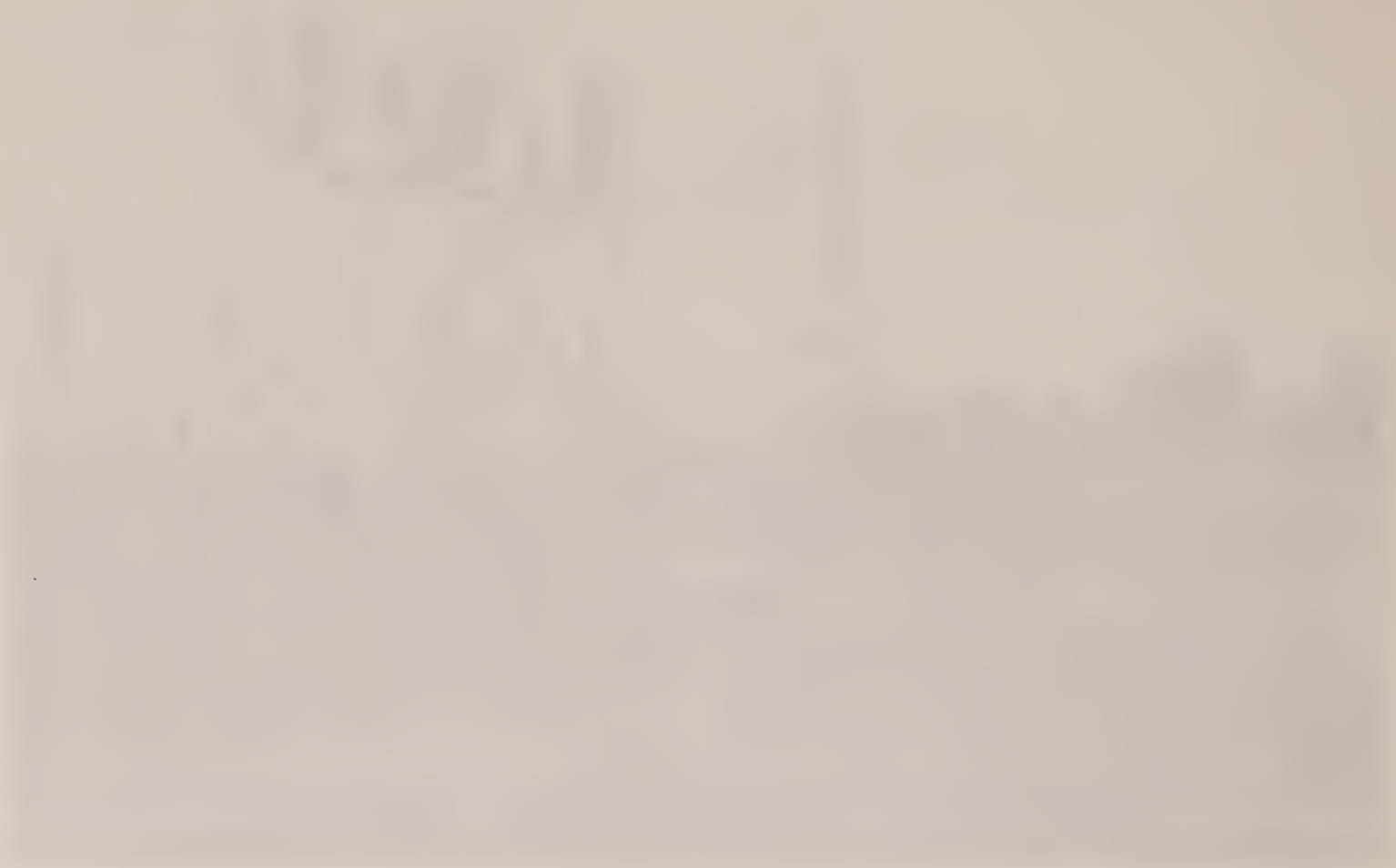


Figure 4-17 High Voltage Switching Equipment Being Installed at the Electrical Switchyard (December 1980)

Figure 4-18 Pouring Footings for the New Modular Offices (July 1980)



modular construction. Existing facilities are shown on the plot plan on Figure 4-6b and facilities key (Table 4-1).

New modular offices to house the project staff were constructed in June and July, 1980. Figure 4-18 shows footings being poured in July 1980. Configuration of this 4 module complex resembles an H-plus-"lazy"-H pattern as shown on Figure 4-6b (labeled "office complex", building #7).

A warehouse for Canadian General Electric (CGE) hoist-related-equipment storage was completed in June. Its interior as it existed in June was as shown on Figure 4-19 and its completed mezzanine as photographed in December is shown on Figure 4-20. A picture of the pipe fabrication shop is shown on Figure 4-21. This shop was completed in December; its location as building #19 is shown on Figure 4-6b.

An environmental storage building to house miscellaneous environmentally-related equipment was completed in December 1980 and is shown on Figure 4-6b as building #39.

4.1.8 Concrete Batch Plant

The concrete batch plant produced 19,250 cubic yards of concrete during 1980, the majority of which was used as shaft lining for the three shafts. In addition, 830 cubic yards of shotcrete were utilized for ground support in stations and connecting drifts. Bulk cement, sand, and aggregate are transported from Rifle to the site by truck. Water for the batch plant operation is hauled from the well on Piceance Creek (24X25).

Construction has commenced on the installation of bi-fold doors to enclose the front portion of the sand/aggregate storage building. Insulation and heating equipment are also being installed in this enclosure, with completion due in early 1981. The cement batch plant and the aggregate storage building are located in Figure 4-6b as facilities #5 and 6 respectively.

4.1.9 Explosives Storage and Use

The explosive storage (powder magazine) area is, as shown on Figure 4-6a, remotely located from areas of major activity. This area was completely fenced prior to year-end. See Figure 4-22. Approximately 228,500 lbs of explosives were consumed in shaft sinking and drift development activities in 1980. A total of approximately 970 blasts were detonated this year.

4.1.10 Water Treatment Facilities

The surface water facilities are designed to dispose of excess mine water by direct discharge from two lower ponds ("A" and "B") (Figures 4-23, 4-24) or by sprinkler irrigation or by the subsurface reinjection into the same general zones being dewatered in shaft and mine development. The system shown on Figure 4-25a was initiated in 1979 for direct discharge from ponds A or B into East No Name Gulch (without sprinkler system). In 1980 the sprinkler system was completed and tested utilizing a lateral distribution system on the ridge between Cottonwood and Sorghum Gulches. See Figure 4-25b for sprinkler details. Subsurface reinjection tests commenced March 3, 1981.

Additions to the facilities to improve operations and ability to properly treat the mine water before discharge were installed. In April, the installation of an acid storage tank and associated piping to Ponds A and B were completed and put into use as the primary means of controlling the pH of the mine water. The acid injection building is designated as #43 on Figure 4-6b. Eyewash and shower facilities were also installed at the acid-injection facility as shown on Figure 4-26.

The gland seal pumps, located in the lower pond pump house were started in May and have been in continuous operation for the remainder of the year. These pumps provide clean water back to all three shafts; this, in turn, is used as cooling-water for those pumps which transfer mine water from the three shafts to Ponds A and B.

A continuing suspended-solids situation prompted the testing of chemical coagulants and flocculants in June. These tests lead to the construction and installation of a Magnaflox (charged polymer) flocculant system in November. See Figure 4-27. This facility is located at Pond A and contains two 500-gallon mixing tanks and metering pumps with piping to Ponds A and B.

The sprinkler system testing began the end of May after completion of Pond C (Figure 4-28). After testing, the system ran as scheduled until the middle of October. (See Figure 4-29.) About 440 gpm was pumped through two movable nozzles for irrigating approximately 100 acres for a total of 39,300,000 gallons or 8.5 acre-inches per acre for the 1980 season.

A total of 509,000,000 gallons from all three shafts had to be treated and disposed of by usage, discharge, or irrigation during 1980 (a 968 gpm average). A complete breakdown of the tract water usage is given in Table 4-4.

4.1.11 Reinjection Facility

This portion of the water-treatment facility was not operational in 1980. Site preparation and construction, however, were underway. During August, a 48-hour pump-down test of the reinjection well was conducted to obtain data on the formation necessary to finalize the design of the reinjection test. The test indicated a high probability of capability to inject up to 450 gpm at no more than 150 psi.

Particle-size testing on Pond-C water has made it necessary to use an upflow sand filter to treat the water to be used from that pond for reinjection, i.e. to remove the suspended solids. A L'eau Claire sand filter has been purchased to meet this requirement and was erected and is being connected to our present pumping system. Completion of the reinjection system is scheduled for the first part of 1981. Figures 4-30 to 4-33 show the reinjection well, its piping, the general system components at Pond C and a close-up of the L'eau Claire filter.

4.1.12 Hydrology Laboratory

A specially equipped trailer for use as a laboratory was

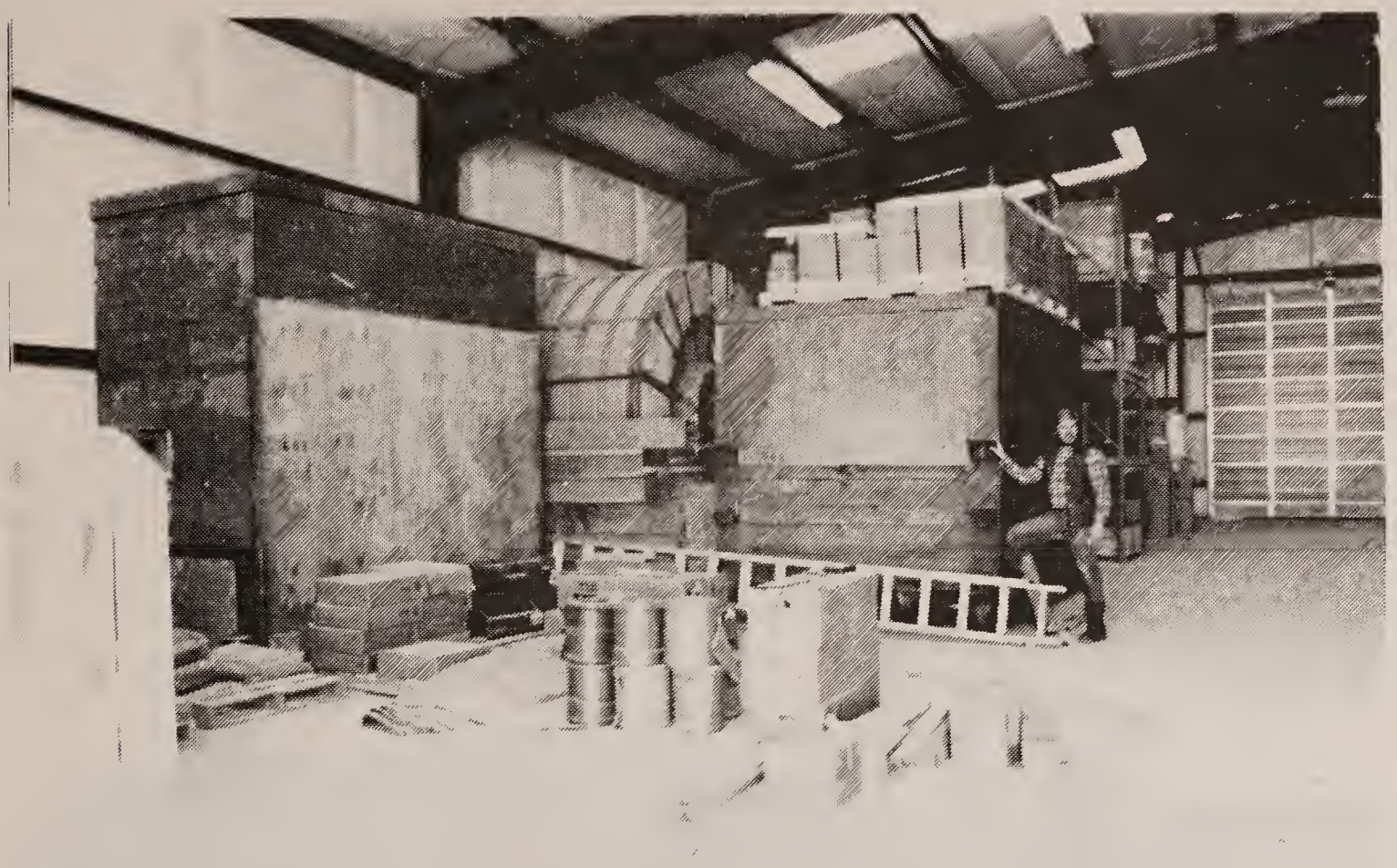


Figure 4-19 Interior of the Warehouse (January 1980)

Figure 4-20

C.B. Warehouse Showing the Completed Mezzanine (December 1980)

Figure 4-21 Framing and Siding for the Pipe Fabrication Shop (December 1980)

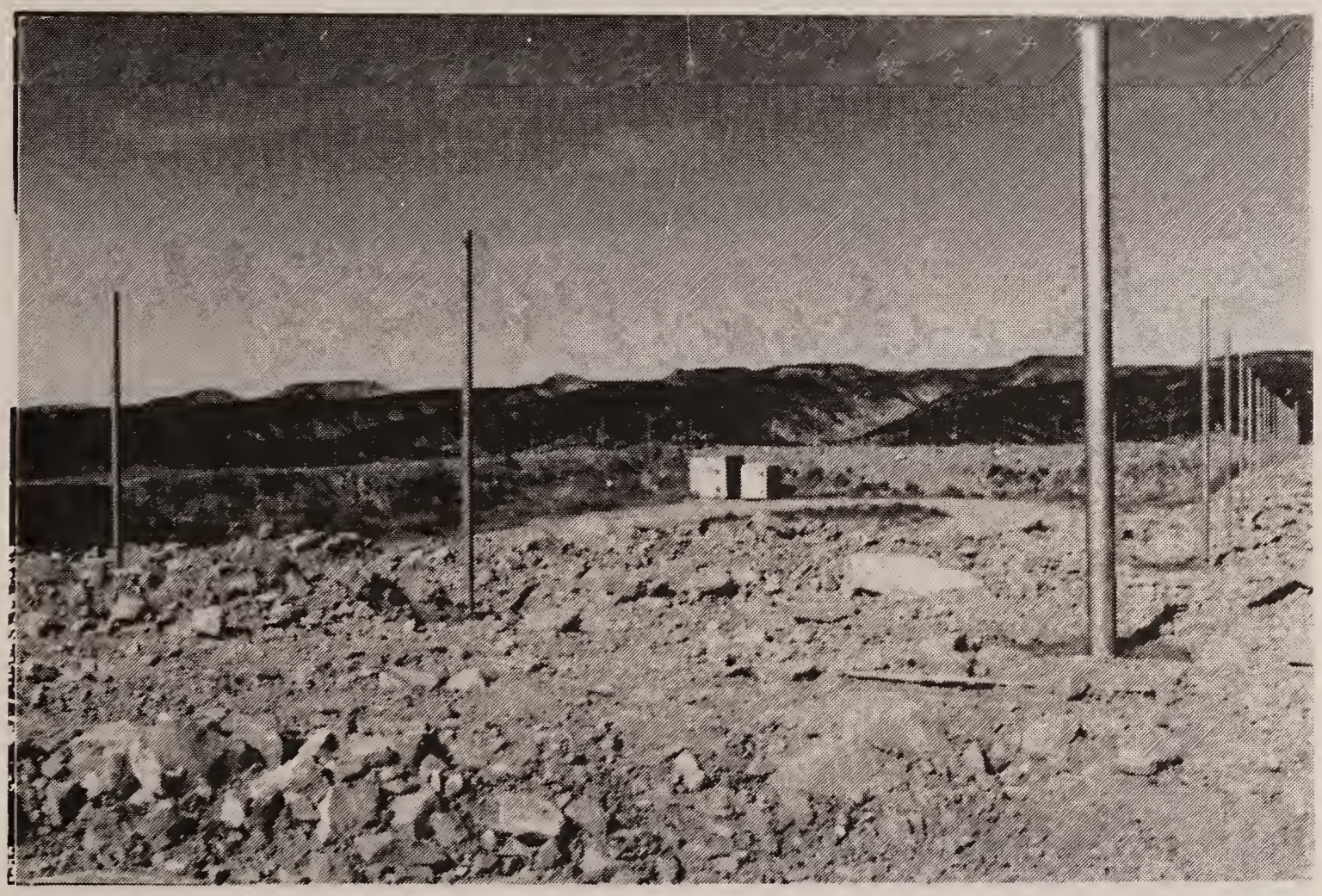


Figure 4-22 Posts for Fencing the Powder Magazine (October 1980)

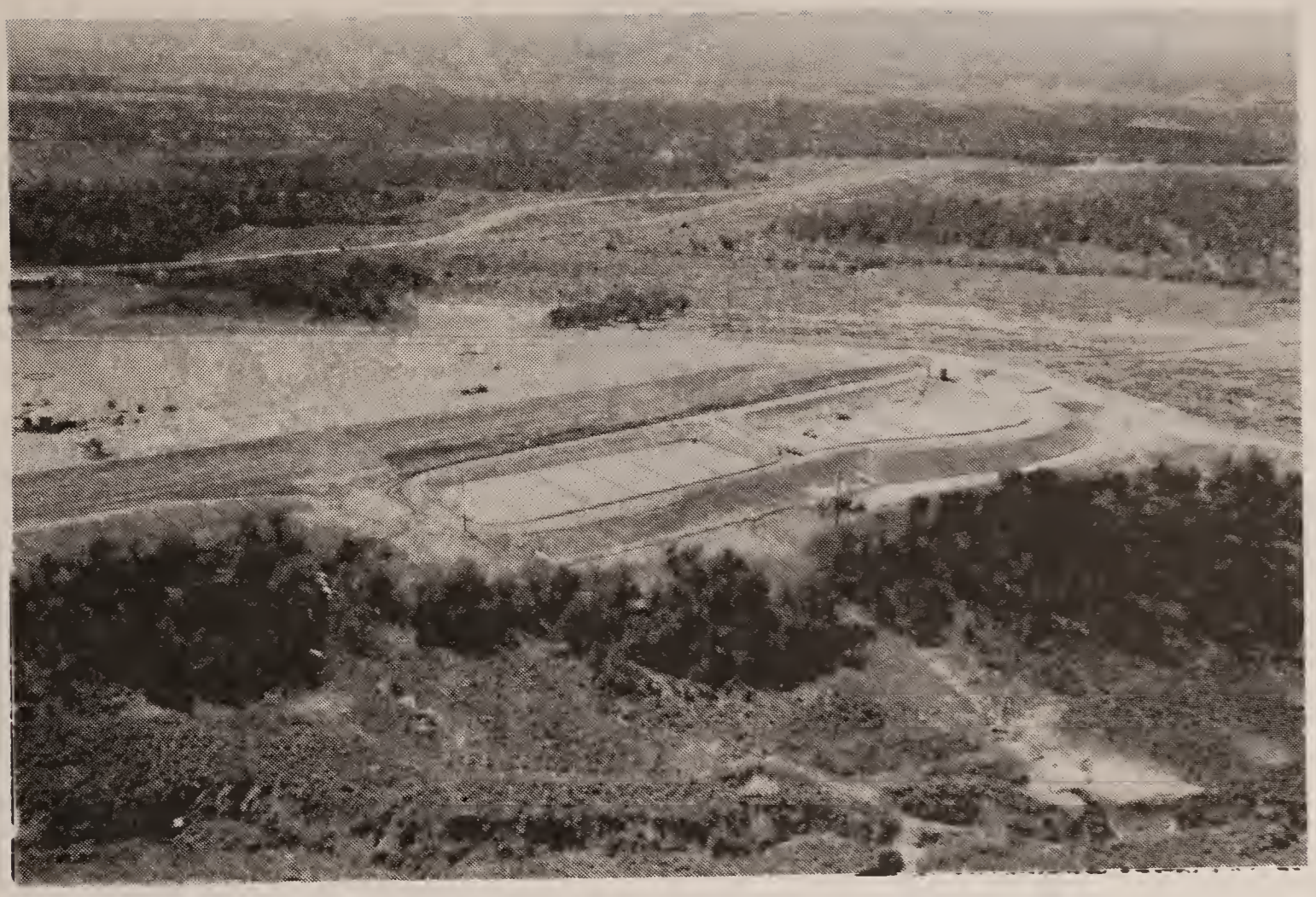


Figure 4-23 Aerial Views of Ponds A/B (April 1980)

Figure 4-24 Settling Baffles Under Construction in Pond A (April 1980)

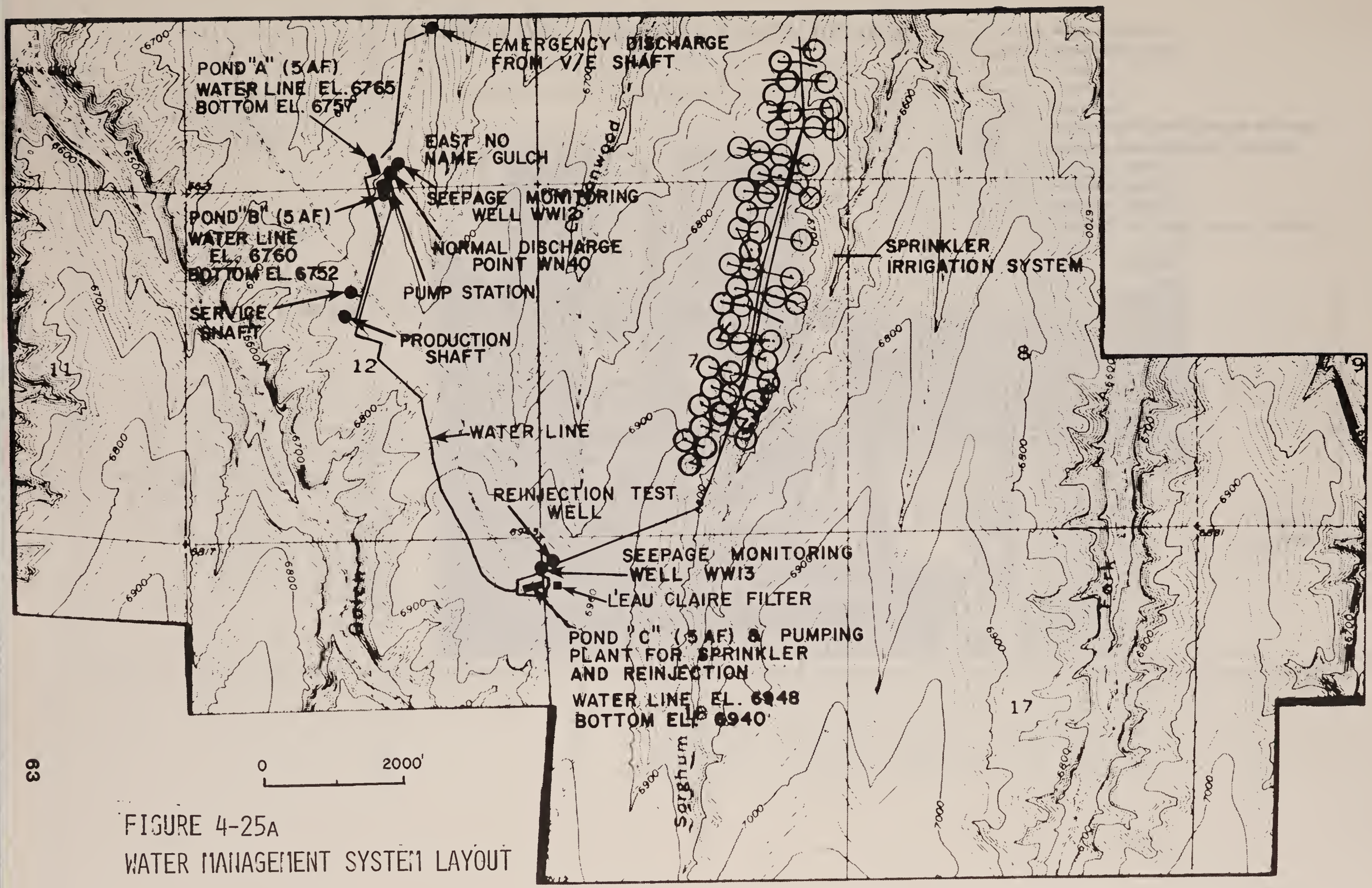


FIGURE 4-25A
WATER MANAGEMENT SYSTEM LAYOUT

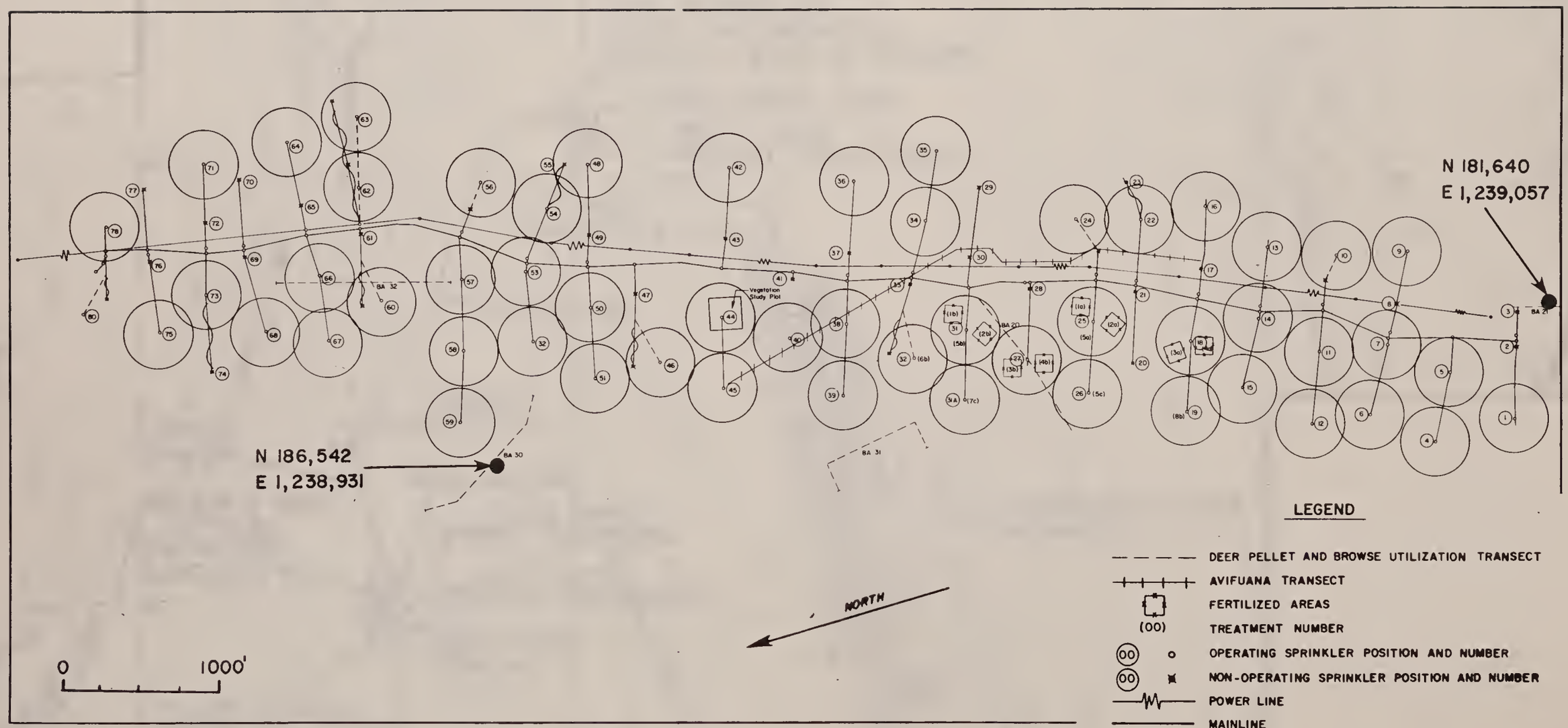


FIGURE 4-25B SPRINKLER IRRIGATION PLAN

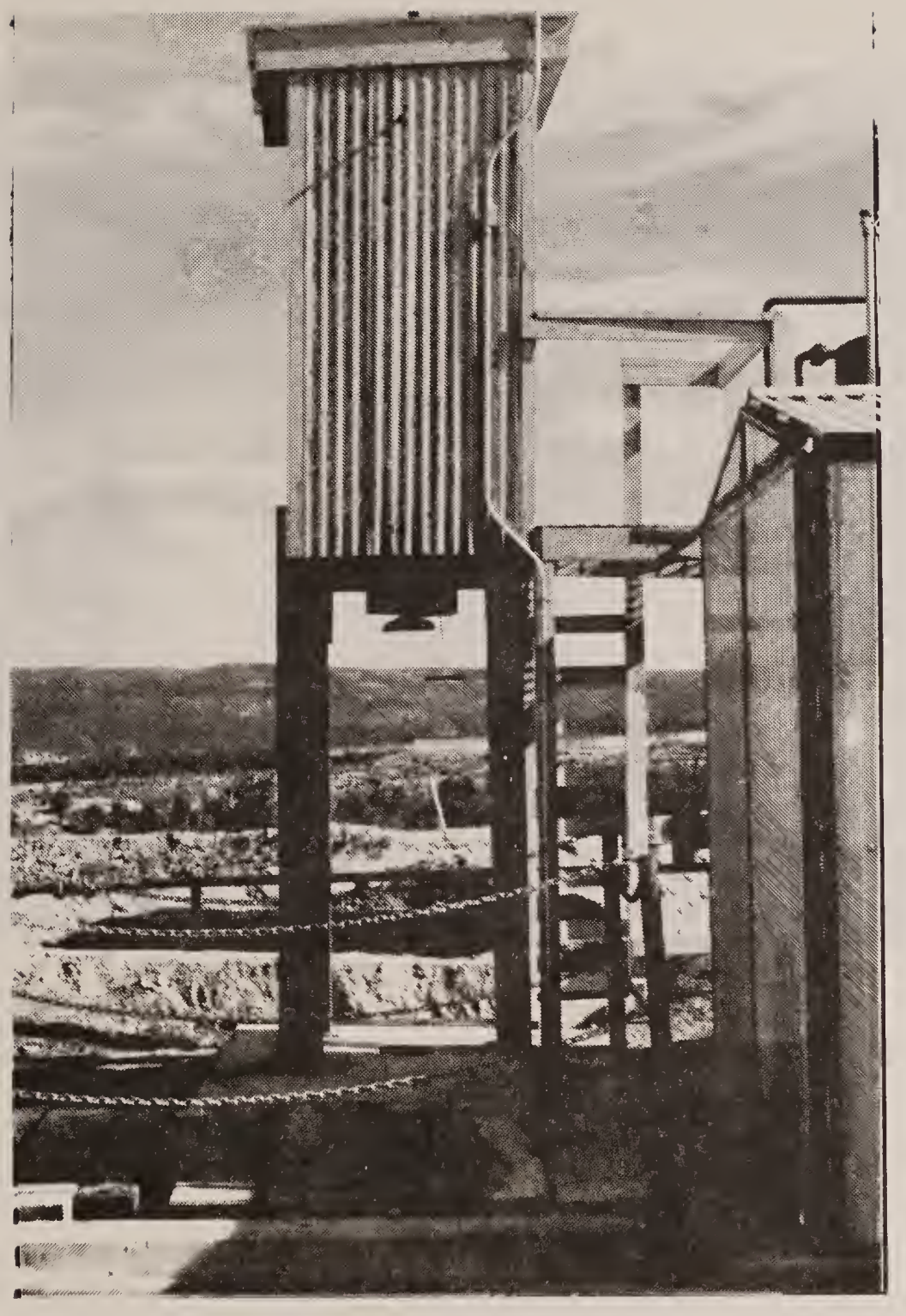


Figure 4-26 Eyewash and Shower Facilities at Pond A and B (October 1980)

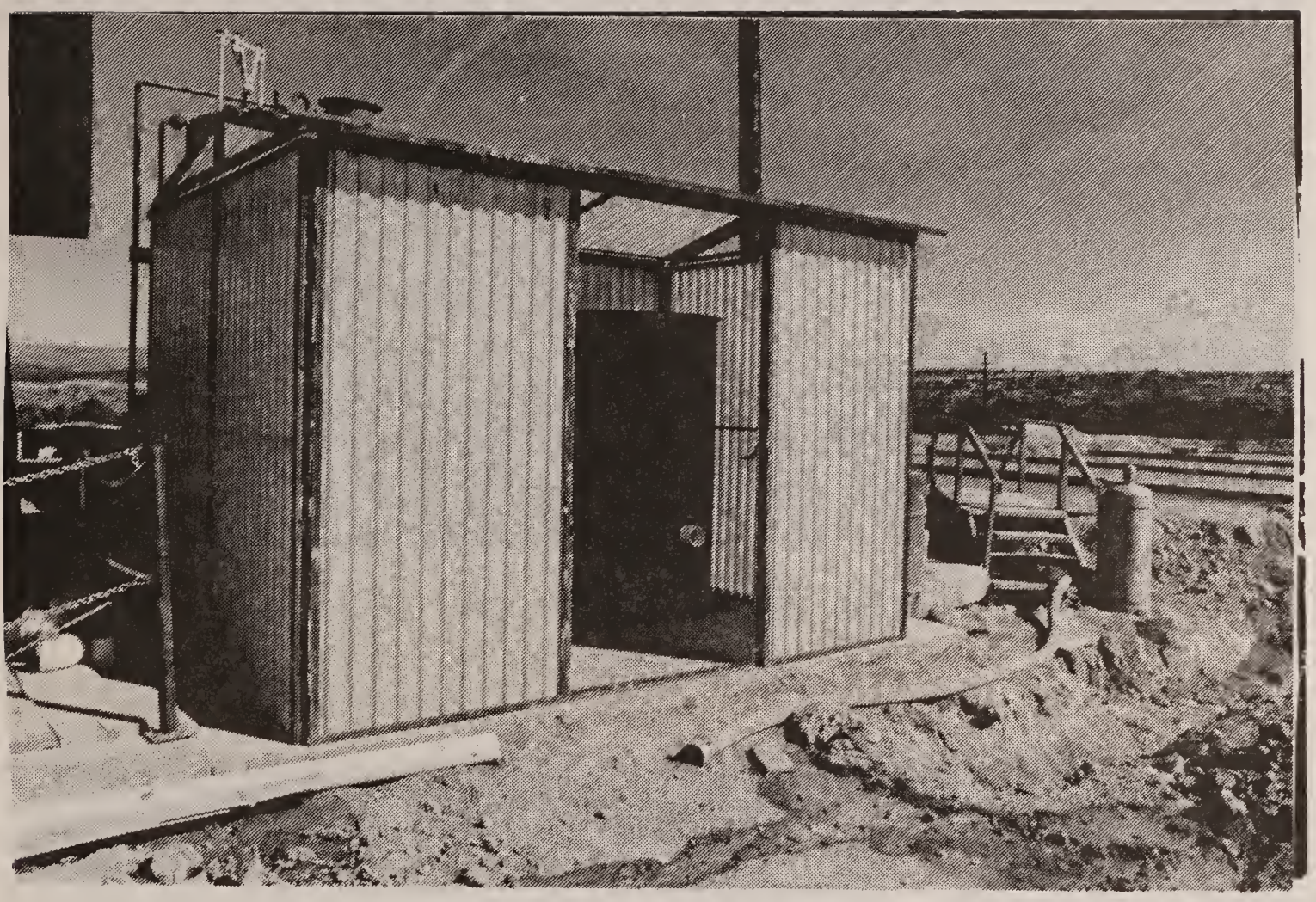


Figure 4-27 Flocculant Feed Tank Installation at Ponds A/B (October 1980)

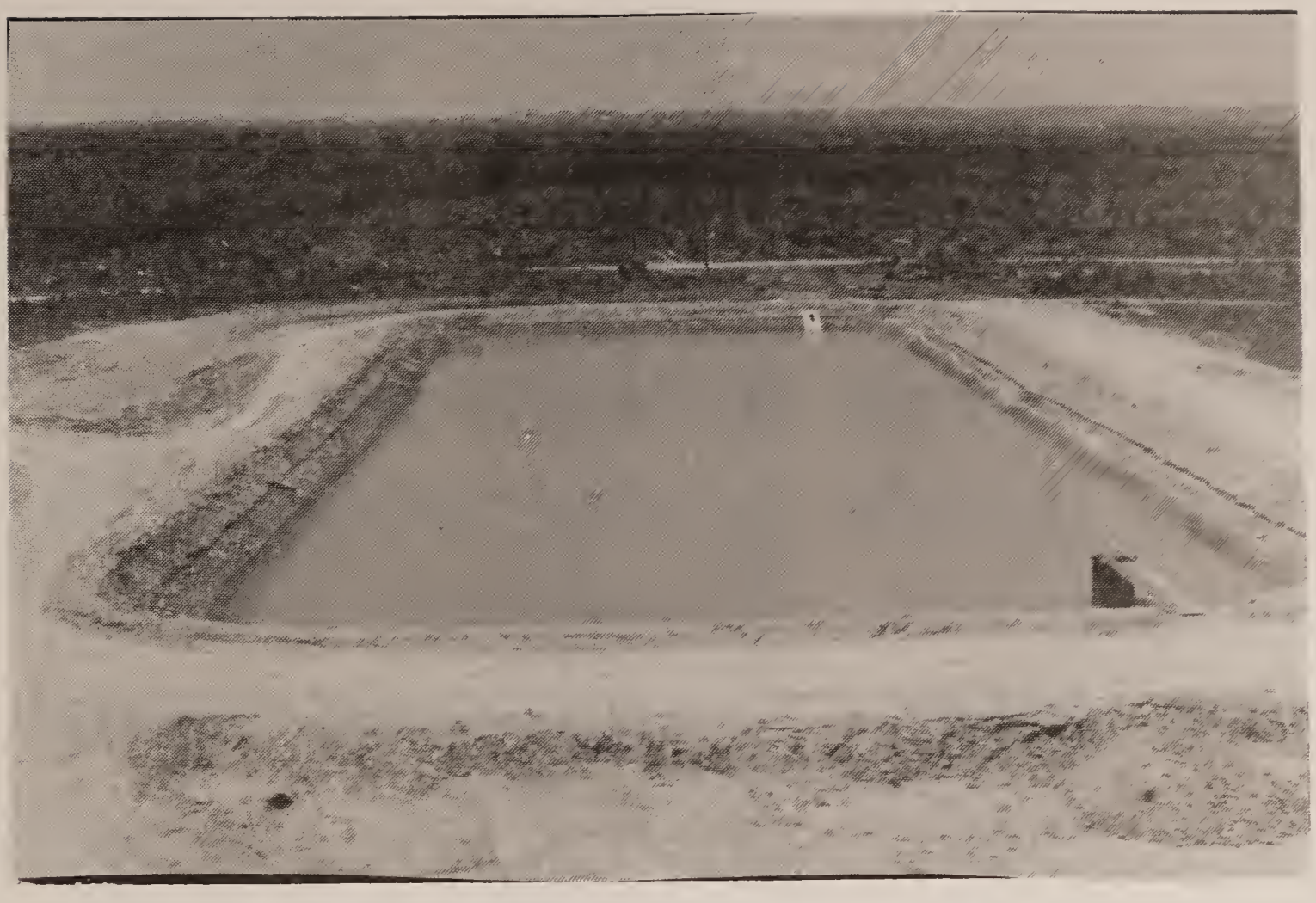


Figure 4-28 Pond C Nearing Completion (May 1980)

Figure 4-29 Land Application (Sprinkler) System Test Near Sorghum Gulch (May 1980)

TABLE 4-4

1981 C-B WATER USAGE (10**6 GALLONS, * =ACRE FEET)

	USE	SOURCE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL YTD	TOTAL YRS TD
OFF-TRACT WTR USED	POTABLE	TOWN	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.03	.03	.29	
			.07*	.06*	.06*	.08*	.08*	.08*	.08*	.08*	.08*	.08*	.08*	.08*	.89*	
*TOTAL OFF-TRACT WTR USED			.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.03	.03	.29	.54
			.07*	.06*	.06*	.08*	.08*	.08*	.08*	.08*	.08*	.08*	.08*	.08*	.89*	1.65*
TRACT WATER USED	BATCH PLNT	24X-25	.00	.00	.00	.00	.06	.20	.12	.09	.12	.12	.12	.08	.90	
			.00*	.00*	.00*	.00*	.19*	.60*	.38*	.27*	.36*	.36*	.36*	.26*	2.78*	
	CONSTR	PONDS	1.75	.10	.15	.23	.57	.00	.80	.48	.39	.25	.21	.03	4.97	
			5.38*	.31*	.47*	.72*	1.74*	.00*	2.45*	1.47*	1.20*	.77*	.64*	.08*	15.24*	
	CONSTR	WELLS	.51	3.12	3.25	4.54	1.01	.08	.18	.24	.23	.29	.31	.37	14.12	
			1.55*	9.59*	9.97*	13.94*	3.09*	.24*	.55*	.72*	.71*	.90*	.95*	1.12*	43.33*	
	DUST CNTL	PONDS	.00	.00	.00	.21	.22	.71	.88	.51	.40	.30	.23	.01	3.48	
			.00*	.00*	.00*	.66*	.68*	2.19*	2.72*	1.55*	1.24*	.92*	.69*	.04*	10.68*	
	GLAND WTR	PUMP STA	.00	.00	.00	.00	.52	6.44	9.51	9.74	9.72	11.60	12.24	11.69	71.45	
			.00*	.00*	.00*	.00*	1.58*	19.76*	29.18*	29.88*	29.83*	35.61*	37.55*	35.86*	219.25*	
	NPDES REL	PONDS	7.63	5.76	22.32	21.01	10.32	2.37	16.49	23.01	28.25	48.71	53.39	56.85	296.10	
			23.40*	17.66*	68.50*	64.46*	31.68*	7.27*	50.61*	70.60*	86.68*	149.46*	163.79*	174.44*	906.56*	
	REINJECT	PONDS	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	
			.00*	.00*	.00*	.00*	.00*	.00*	.00*	.00*	.00*	.00*	.00*	.00*	.00*	
	SPR IRRIG	POND C	.00	.00	.00	.00	.87	7.86	8.01	14.07	7.18	3.33	.00	.00	39.31	
			.00*	.00*	.00*	.00*	2.67*	24.12*	18.43*	43.16*	22.03*	10.21*	.00*	.00*	120.63*	
*TOTAL TRACT WATER USED			9.89	6.98	25.73	26.00	13.57	17.66	34.00	48.12	46.30	64.60	66.48	69.03	430.34	480.81
			30.33*	27.56*	78.94*	79.77*	41.63*	54.19*	104.32*	147.66*	142.06*	198.23*	203.98*	211.80*	1320.48*	1475.32*
WATER IN STORAGE	-	POND A	.00	1.50	.95	1.35	1.70	1.70	1.70	.00	1.70	1.70	1.70	1.70	.00	
			.00*	4.60*	2.92*	4.14*	5.22*	5.22*	5.22*	.00*	5.22*	5.22*	5.22*	5.22*	.00*	
	-	POND B	.75	1.20	.00	.00	1.50	1.50	1.50	1.30	1.50	1.50	1.50	1.50	.00	
			2.30*	3.68*	.00*	.00*	4.60*	4.60*	4.60*	3.99*	4.60*	4.60*	4.60*	4.60*	.00*	
	-	POND C	.00	.00	.00	.70	1.00	1.50	1.00	1.50	1.50	.15	.00	.00	.00	
			.00*	.00*	.00*	2.15*	3.07*	4.60*	3.07*	4.60*	4.60*	.46*	.00*	.00*	.00*	
*TOTAL WATER IN STORAGE			.75	2.70	.95	2.05	4.20	4.70	4.20	2.80	4.70	3.35	3.20	3.20	.00	
			2.30*	8.28*	2.92*	6.29*	12.89*	14.42*	12.89*	8.59*	14.42*	10.28*	9.82*	9.82*	.00*	
WATER PUMPED	-	32X-1	.04	1.33	.94	1.91	.06	.00	.00	.00	.00	.00	.00	.00	4.32	
			.11*	4.19*	2.89*	5.87*	.20*	.00*	.00*	.00*	.00*	.00*	.00*	.00*	13.26*	
	-	24X-25	.51	.39	1.05	.08	.23	.35	.34	.24	.23	.29	.31	.37	4.39	
			1.55*	1.21*	3.23*	.24*	.72*	1.07*	1.04*	.72*	.71*	.90*	.95*	1.12*	13.46*	
	-	32X-12	.00	1.37	1.25	2.55	.71	.00	.00	.00	.00	.00	.00	.00	5.88	
			.00*	4.19*	3.85*	7.82*	2.18*	.00*	.00*	.00*	.00*	.00*	.00*	.00*	18.04*	
	-	V/E SHAFT	8.50	7.64	13.42	15.47	16.68	16.68	14.96	32.32	37.91	48.97	46.52	44.72	303.80	
			26.07*	23.44*	41.17*	47.46*	51.19*	51.18*	45.92*	99.19*	116.32*	150.27*	142.75*	137.23*	932.19*	
	-	PROD & SERV	3.57	3.61	6.24	7.74	12.57	19.09	27.14	21.34	26.26	25.29	25.24	27.27	205.56	
			10.96*	11.08*	19.15*	23.75*	38.56*	58.58*	83.28*	65.47*	80.58*	77.60*	77.46*	83.67*	630.14*	
POSITION PAPER NOW *TOTAL WATER PUMPED			12.61	14.38	22.91	27.75	30.26	36.12	42.45	53.90	64.40	74.55	72.07	72.20	522.75	597.35
			38.69*	44.11*	70.28*	85.14*	92.84*	110.84*	130.24*	165.38*	197.62*	228.77*	221.13*	221.13*	1603.43*	1832.92*

Figure 4-30

Reinjection Well Near Pond C

(January 1980)

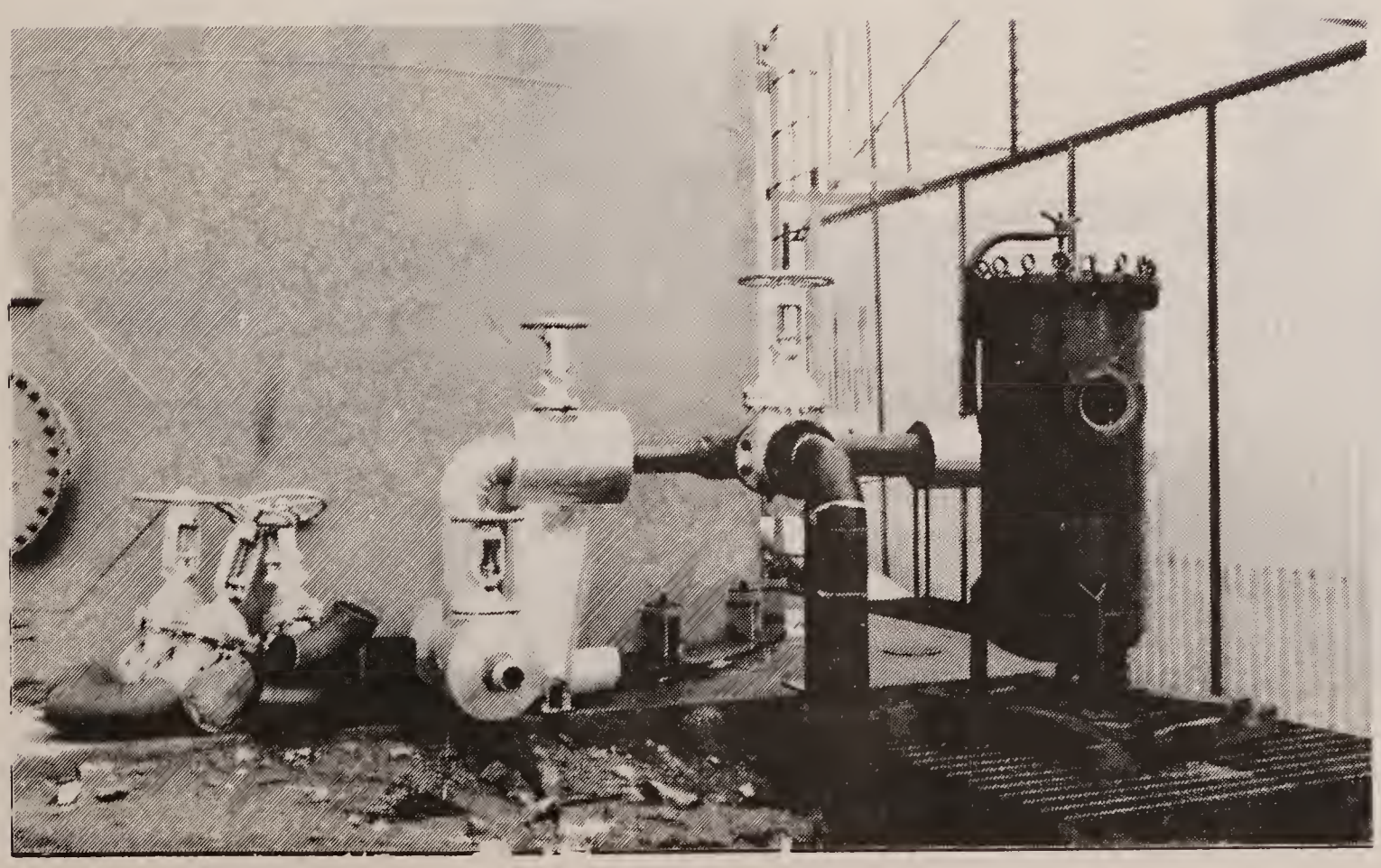


Figure 4-31 Piping for Final Filter at Reinjection Well (July 1980)

Figure 4-32 Pond C Location Showing L'eau Claire Sand Filter and Pumphouse (October 1980)

Figure 4-33 Close-up of the L'eau Claire Sand Filter - 70% complete (October 1980)

assembled and occupied in October. This lab is equipped with all the necessary laboratory and safety equipment and supplies to ensure the proper preparation and testing of water samples and to provide analytical capabilities for future growth.

4.1.13 Summary of Engineering Status

1980 was an active period in both on-site construction engineering and engineering at the Grand Junction office.

4.1.13.1 On-Site Engineering

Reinjection/Water Treatment

The reinjection system progressed with the design of a filter system to alleviate problems due to suspended solids in the mine water. Engineering was performed at C-b with utilization of hydrologic and water-treatment consultants.

Sewage Plant

A 9,000 G.P.D. sewage treatment installation was near completion at year end.

Heliport

A 1/2 acre helipad was completed and placed in operation. The heliport includes a fully equipped visitor facility in addition to aviation lighting and refueling facilities.

Truck Weigh Scale

Nearing completion at year-end, the weigh scale will be used for weighing trucks delivering materials to C-b. The scale has a nominal 60 ton capacity and is equipped with electronic read and print-out capability in addition to a communications system and covering building. It is located near the access-road guard gate.

Colorado-Ute

Liaison continued with White River Electric relative to design and construction of substations for the planned 138 KV power transmission line from Meeker to be built during the summer of 1981. Work included substation construction at both the tract and Meeker.

Headframes

A complete bid package for outfitting the headframes was assembled by Dravo Corporation under C-b direction. Evaluation is in progress.

Rifle Parking Lot

Efforts are underway to extend and improve the parking lot in Rifle located on Railroad Avenue at 21st Street.

General

Technical support was provided during shaft sinking and mining activities relative to ventilation system design and equipment selection. A quality control program was initiated covering concrete and soils. Technical support was also provided for minor design projects such as winterizing the batch plant, office expansion and laboratories.

4.1.13.2 Off-Site Engineering Studies

Fluor

Fluor Engineers and Constructors, Inc., Houston Division, under contract to Cathedral Bluffs, performed engineering work that resulted in the following reports:

1. Best Available Control Technology Study of Sulfur Removal from modified In-Situ Offgas (March, 1980).
2. Tract C-b Commercial Surface Process Facilities, Cost Estimate, Case VA (April, 1980).
3. Engineering Report and Estimate Surface Process Facilities, 290' Retort and #6 Design (October, 1980).

CH2M-Hill

CH2M-Hill of Seattle, Washington prepared the report "C-b Tract Water Management Study".

Lurgi

Lurgi Kohle u. Mineraloeltechnik GMbH of Frankfurt, West Germany prepared the report "LR-Retorting Plant for C-b Tract Colorado Oil Shale".

Woodward-Clyde

Woodward-Clyde Consultants of Denver, Colorado prepared the report "Preliminary Laboratory Testing of Retorted Shale".

Dravo

Dravo performed engineering studies related to shaft-outfitting, design of mine support buildings, plot plan development, commercial mine design, and Detailed Development Plan support.

4.2 Off-Tract Facilities Description

4.2.1 Grand Junction Office

The headquarters facility at 751 Horizon Court (Figure 4-34) has been in use since January of 1979.

4.2.2 Grand Junction Laboratory

Occidental's Grand Junction analytical-chemistry laboratory is located at 2372 G Road. In addition, an on-Tract lab facility was completed in 1980.

4.2.3 Rifle Warehouse and Railroad Project

The project continues to use a rail siding adjacent to the Rifle railroad station for off-loading of bulk materials necessary for construction.

4.2.4 Rifle Parking Lot

A parking lot has been established next to the Rifle Gap apartments for the convenience of commuters utilizing the bus to the C-b Tract.

4.2.5 Utility Corridors

A four-inch natural gas line to the Mine Development Area was installed by the Western Slope Gas Company in 1979. This line supplies natural gas to an electric generating plant consisting of nine 1,000 KW gas-engine-driven generators, with space for one additional generator. The generator plant is presently supplying the electrical power for shaft sinking, mine water pumping, and miscellaneous power and lighting requirements.

The first stage of an electric power supply system for the project is presently under construction by the White River Electric Association, Inc. It is to be completed this summer. This consists of a single 138,000 volt transmission line from Meeker to the project where it will connect to a 30,000 KVA transformer in a substation at the mine support area; corridor routes were shown in last year's annual report. This line will supply power to the 13,800 volt distribution system for the mine. It is expected that this system will be in service in the fall of 1981. At that time, the power will be needed for testing and startup of the permanent main hoists. The gas engine generator plant will be converted to emergency service at that time.

4.3 Access/Service/Support/Activities

4.3.1 Roads and Guard Rails

Main roadways on the site were surfaced with gravel in 1980 with 175,000 cubic yards of minus 1" roadbase placed, crowned, and compacted. In addition, areas with heavy vehicular traffic and equipment storage were gravel-surfaced for dust suppression and mud control. Berms along embankments were removed to improve drainage and were replaced with metal guardrails. 4500 linear feet of guard rails were installed in this effort.

4.3.2 Truck Weighing Facility

Truck weigh scales were installed at the security gate to weigh shipments of materials and equipment received on tract. These scales have the capability of weighing truck loads up to 60-ton gross weights with automatic print-out capabilities. Photos of the truck-weighing facility are shown on Figures 4-35a and 4-35b.

4.3.3 Fuel Storage and Dispensing

Installation of the permanent fuel dispensing facility was completed in 1980. Its location is shown on Figure 4-6b as facility #16. This system is computer-controlled for accounting and control purposes. All tanks for diesel fuel and gasoline storage are connected to this system. Liquid petroleum gas storage tanks are located there to supply gas as required to buildings and facilities. Fuel consumption during the year was 221,000 gallons of diesel fuel, 63,957 gallons of gasoline, 24,332 gallons of LPG and 618,659 mm BTU of natural gas.

4.3.4 Sewage Treatment Facility

Construction of the sewage treatment facility was 90% complete in 1980 with completion of the unit scheduled for January of 1981 (See Figure 4-36). The facility consists of a 9,000-gallon-per-day activated-sludge secondary package treatment unit manufactured by Environmental Conditioners, Inc., a polishing pond and the necessary piping to discharge. Raw sewage will be hauled by truck from holding tanks and injected into the treatment unit.

4.3.5 Gland Seal Water Supply

Water for the gland seal system to the Ventilation/Escape, Production and Service Shafts is supplied by pumps located at the lower pond pump house and piped underground to the shafts. Water is supplied from the discharge of Pond "B" where suspended solids have largely been removed by settling. Average usage for the gland seal system was 115 gpm at the Vent/Escape Shaft and 120 gpm at the Service/Production Shafts.

4.3.6 Fire Water Loop System

Until such time as the C.B. surface plot plan is finalized, no new design work on the Fire Water Loop System will be undertaken.

4.3.7 Pipelines

No product pipelines were installed in 1980. Minimal footages of buried water lines were installed in relation to the L'eau Claire Filter and reinjection facility.

4.3.8 Communications

With the exception of additional extensions to the present PBX system, no new telephone installations were made during the year.

Figure 4-34 Occidental Oil Shale's Grand Junction Office Building

Figure 4-35a
Truck Weighing - Scale Building
(December 1980)

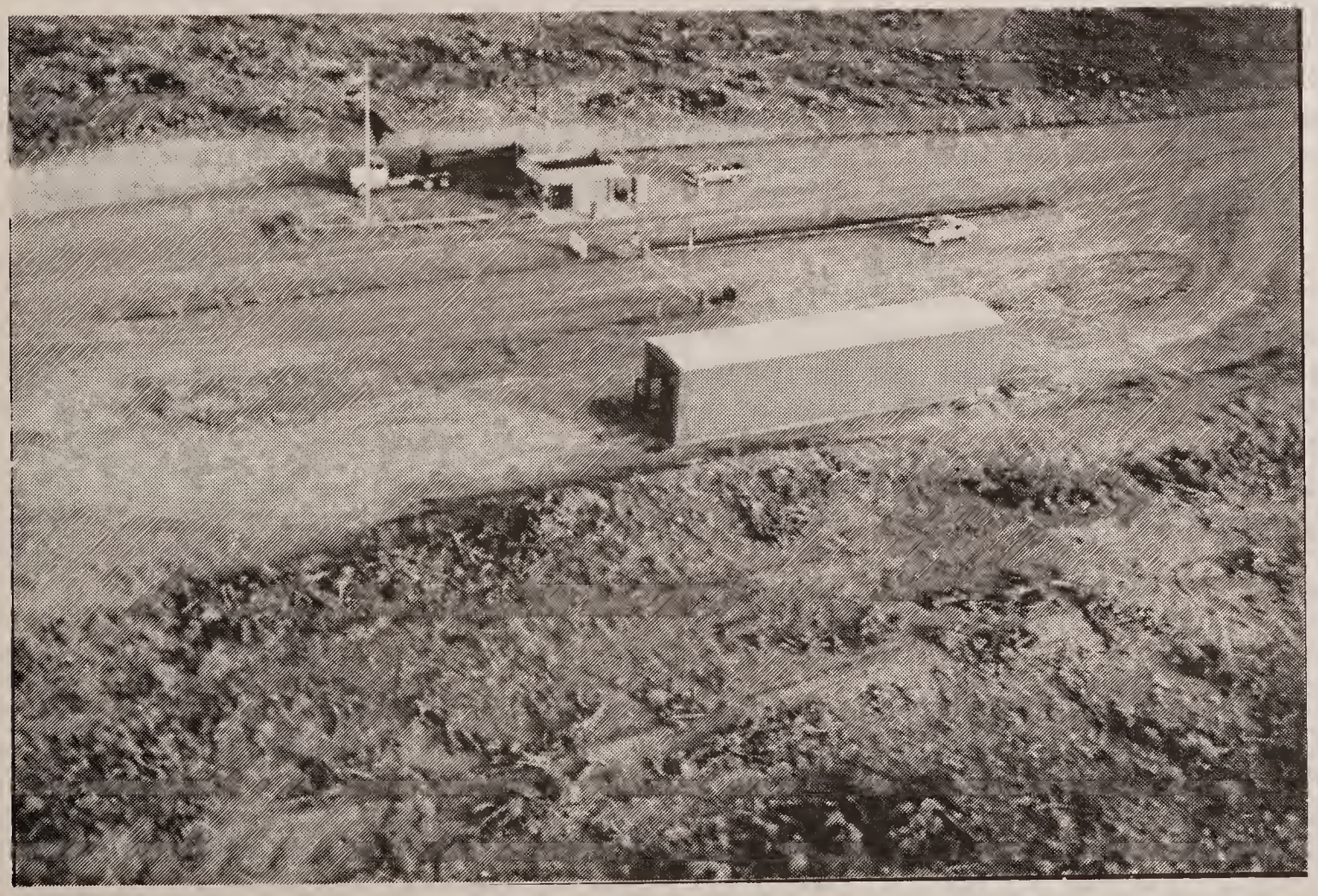


Figure 4-35b Aerial View of Truck Weighing - Scale Building and Guard Gate
(December 1980)

4.3.9 Helicopter Pad

To facilitate landing of helicopters at the C-b Tract, a 100 x 250 foot paved, lighted heliport was designed and constructed during 1980, as shown on Figure 4-37. Location of this facility adjacent to the public relations (visitor) facility is shown on Figure 4-3. The facility was designed to land and park two helicopters. Aviation fuel storage and dispensing facilities are available.

Scheduled helicopter passenger service between Logan Wash, Grand Junction and C-b is accomplished by a Bell 206L1 Long Ranger Helicopter. This service began in the first quarter of 1980. Emergency medical transportation is also provided by this helicopter.

4.3.10 Aerial Survey

As mentioned in Section 4.1.1, an aerial survey of the Tract was conducted on August 27, 1980 by Scharf and Associates, of Denver, Colorado. Ground survey control was furnished by Construction Surveys, Inc., Rifle, Colorado. From this, 1:7200 and 1:2400 topographic maps of the Tract were prepared along with an aerial mosaic. Landsat was also utilized in the summer period to study general vegetative condition as discussed in Volume 2, Chapter 4.

4.3.11 Surface Mobile Equipment

Roadways were sprinkled with water on an as-needed basis (usually daily) during the summer months. Dust suppressant (Coherex/water mix) was applied on a scheduled basis or as conditions dictated. A rubber-tired road grader maintained the road surface and loaders and trucks were used on an as-needed basis to clean ditches, culverts, etc. Snow removal and road-sanding crews were on 24-hour call for road maintenance during winter months.

4.3.12 Consumables Usage

Monthly water reports to the State Engineer include the water data depicted on Table 4-4: water pumped from the shafts, water used and discharged, and water stored. In addition to these data, quarterly reports to the EPA under the existing Prevention-of-Significant-Deterioration (PSD) permit report the information on Table 4-5 for addition consumables: fuels, acid treatment in ponds, dust palliatives, shaft rock and shale mined, explosives used, and disturbed acreage.

4.4 Mining

As in 1979, the major Tract activity this past year has been the sinking of the Production Shaft, the Service Shaft and the Ventilation/Escape Shaft. The sinking techniques employ the conventional drill, blast, muck-out and line sequence. Multiple small drill holes (under 2 inches) are sunk in approximately 8-feet lengths, filled with dynamite, blasted, and mucked-out. This sequence is repeated until about 25 feet of shaft is sunk (in Service and V/E Shafts or 30 feet in the Production Shaft). Then the shaft is lined with concrete.

TABLE 4-5

1980 C-b Comsumable Usage

	USE	UNIT	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL YTD
WTR TREATMENT-ACID	POND A	10**3 GAL	.93	2.31	3.52	3.92	4.30	5.35	5.85	5.97	6.39	8.16	8.45	5.07	60.22
	POND B	10**3 GAL	1.37	.16	.33	.00	.00	.00	.00	.00	.00	.00	.00	.00	1.87
DIESEL FUEL #1	-	10**3 GAL	1.13	.52	.17	.02	.03	.09	.05	.01	.01	11.85	6.69	6.68	27.27
DIESEL FUEL #2	-	10**3 GAL	3.49	12.81	3.31	2.37	8.15	5.39	7.21	12.89	9.01	5.24	6.49	3.52	79.90
GASOLINE	-	10**3 GAL	7.64	8.31	6.66	8.34	6.94	6.89	6.71	7.16	6.56	7.76	5.71	8.43	87.12
PROPANE	-	10**3 GAL	4.62	1.59	5.53	2.52	1.20	.03	.00	.90	.90	3.46	4.49	14.23	39.49
NATURAL GAS	-	10**3 MMBTU	18.31	21.50	21.93	22.55	24.50	24.71	24.38	26.55	33.54	34.25	33.42	35.12	320.75
DUST PALLIATIVE	-	10**3 GAL	.00	.00	.00	.00	.11	.66	5.00	3.00	2.00	.00	.00	.00	10.77
MINED SHALE	-	10**3 CU YD	.08	3.78	7.83	5.89	7.87	4.57	8.24	4.44	8.17	10.60	5.46	8.06	75.00
MINED SHAFT ROCK	-	10**3 CU YD	5.60	5.80	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	11.40
EXPLOSIVES	-	10**3 LBS	19.00	22.05	27.87	16.75	14.90	13.97	20.65	20.72	17.75	17.25	21.95	15.57	228.45
EXPLOSIVES FREQ.	-	10**3	.06	.07	.11	.07	.08	.07	.09	.10	.07	.08	.09	.08	.97
DISTURBED ACREAGE	-	10**2 ACRES	166.00	166.00	166.00	166.00	166.00	166.00	166.00	166.00	168.00	168.00	168.00	168.00	.00

Figure 4-36 Site Preparation at the Sewage Treatment Plant (October 1980)

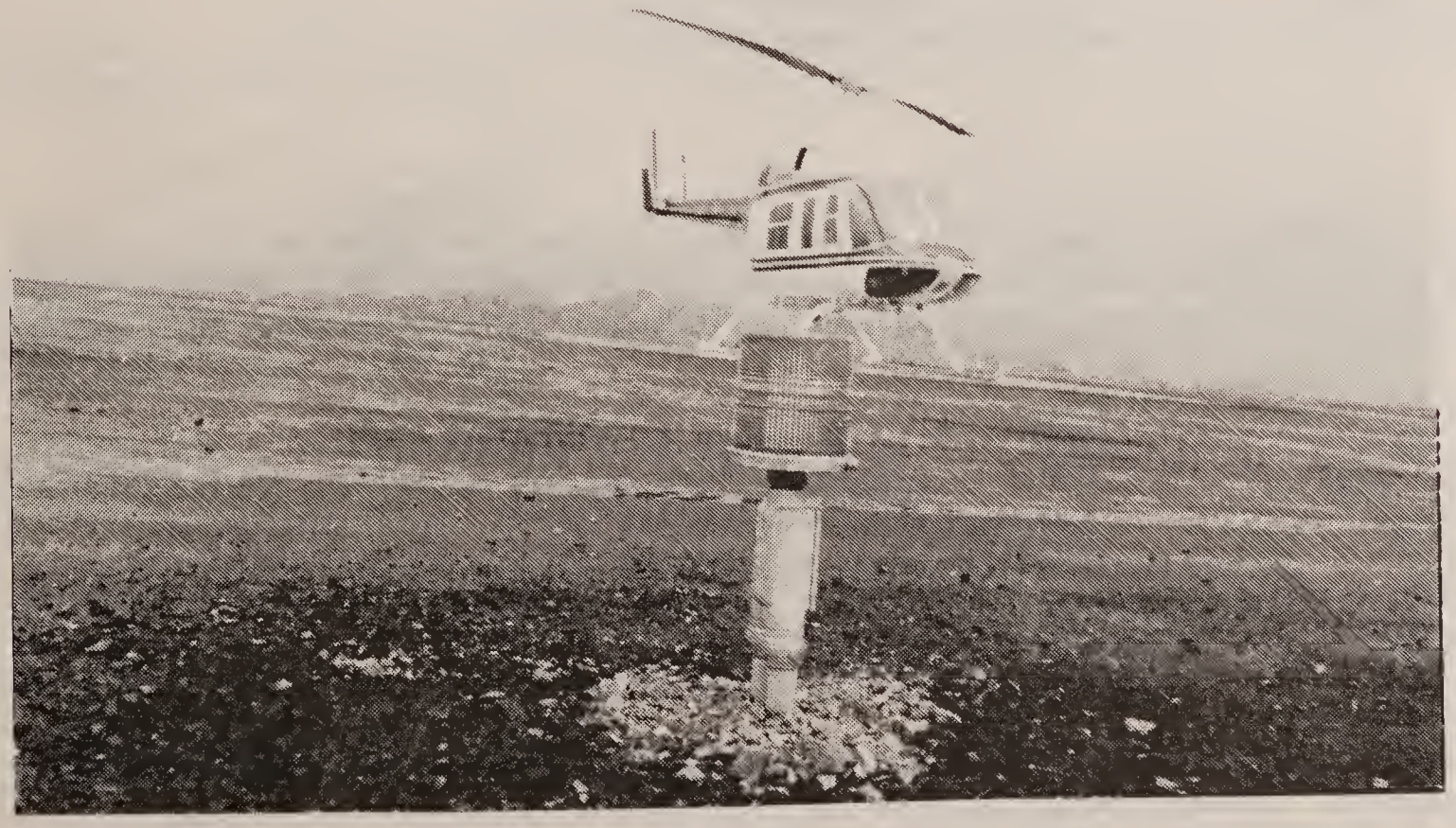


Figure 4-37 Helicopter at the Heliport (July 1980)

4.4.1 Production Shaft

Shaft sinking progress for the 29-foot diameter Production Shaft is shown on Figure 4-38. Stratographic cross-sections are identified in Chapter 5, Volume 2. Sinking progressed from a depth of 850 feet (elevation 6008) at year end 1979 to a depth of 1606 feet (elevation 5223) at the end of 1980. Four mining level stations -- Mid-Shaft, Ignition, Upper Void, and Intermediate Void Levels -- were completed and excavation of the Lower Void Level was started in 1980 (see 4.4.5).

4.4.2 Service Shaft

Progress in the 34-foot diameter Service Shaft reached a depth of 1522 feet (elevation 5307) below the collar as compared to 790 feet of depth at year end 1979 (Figure 4-38). Four level stations -- Mid-Shaft, Ignition, Upper Void, and Intermediate Void Levels -- were completed in 1980 (see 4.4.5). Water make at year end for both Production and Service shafts was 611 gpm with a yearly average of 391 gpm; corresponding values in 1979 were 80 gpm and 34 gpm respectively.

4.4.3 Ventilation/Escape Shaft

Shaft sinking progress for the 15' diameter Ventilation/Escape Shaft has reached a depth of 1302 feet (elevation 5403) (Figure 4-39). Water make for the shaft averaged 578 gpm for the year and is approximately 1002 gpm at year's end. Corresponding values in 1979 were 81 gpm and 167 gpm respectively. The shaft station was completed on the Ignition Level and work is nearing completion on the Upper Void Level Station.

Four grout curtains were completed during 1980 as a water control measure. A total of 10,235 sacks of cement were pumped into the formations during these grouting cycles.

4.4.4 Mine Ventilation

As noted in Section 7.9.2.3 the shafts were classified as gassy by MSHA on 1/2/80. The ventilation system has therefore been designed to comply with gassy mine regulations and conditions. Methane monitoring is discussed in Section 7.9.2.3 and in Volume 2.

The Service Shaft is equipped with a 75 Hp blower fan plus propane air heater at the surface. At the Intermediate Void Level (See Section 4.4.5) on the Service Shaft a 100 Hp suction fan connected to a 36-inch ventilation tube moves the air to the bottom of the Service Shaft and exhausts it up the Production Shaft. Also at the Intermediate Level in the Production Shaft a 100 Hp suction fan connected to a 36-inch ventilation tube moves air from the bottom of the Production shaft and exhausts it up that shaft.

The V/E Shaft ventilation was improved by installing two twin 50 Hp (i.e. 200 Hp total) main fans on the surface as blowers down a 30-inch vent line; additional 60 Hp booster fan at the 1050-ft level then blows air up the V/E Shaft.

FIGURE 4-38

PRODUCTION SHAFT AND SERVICE SHAFT ELEVATION AND COMBINED WATER MAKE VS TIME

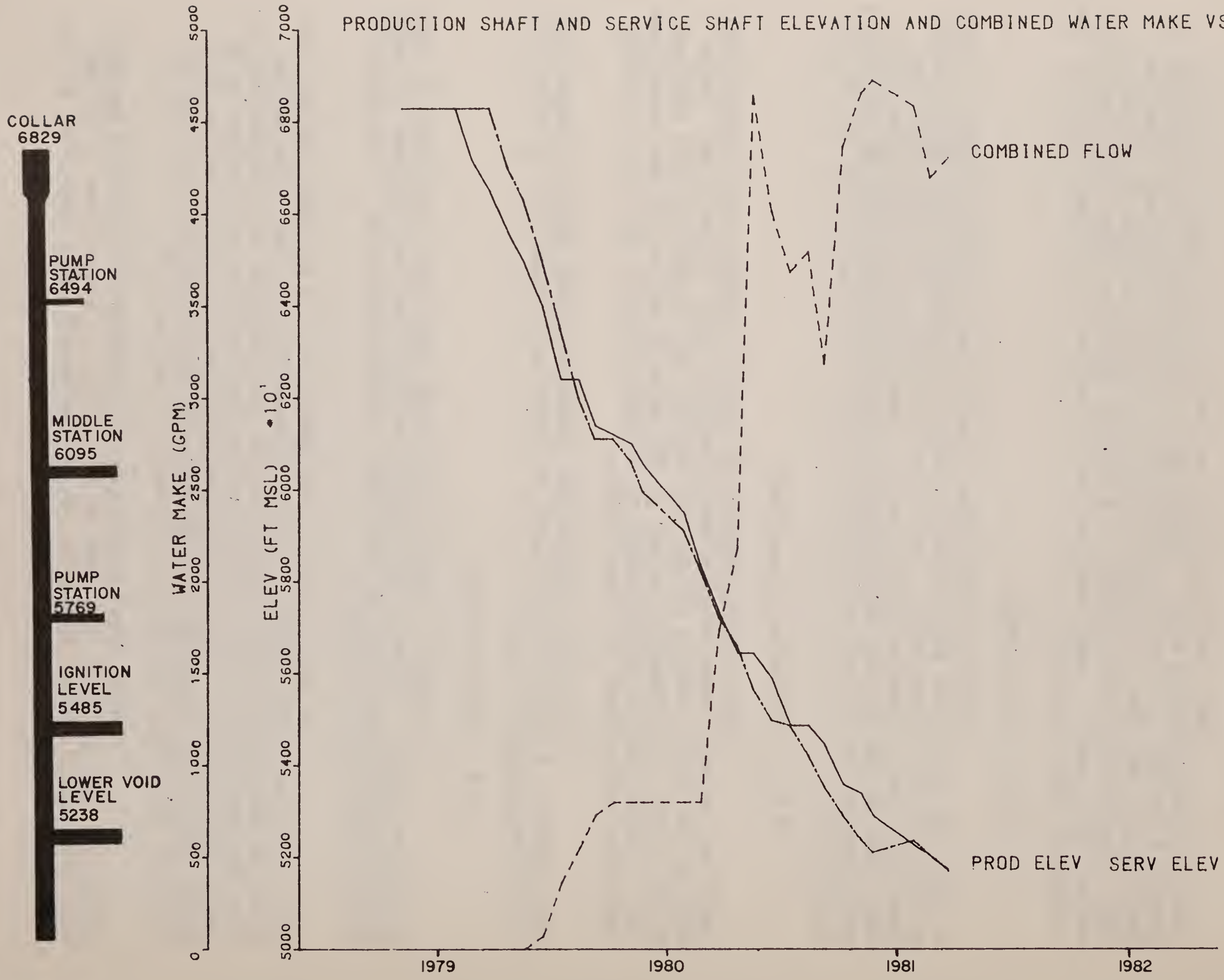
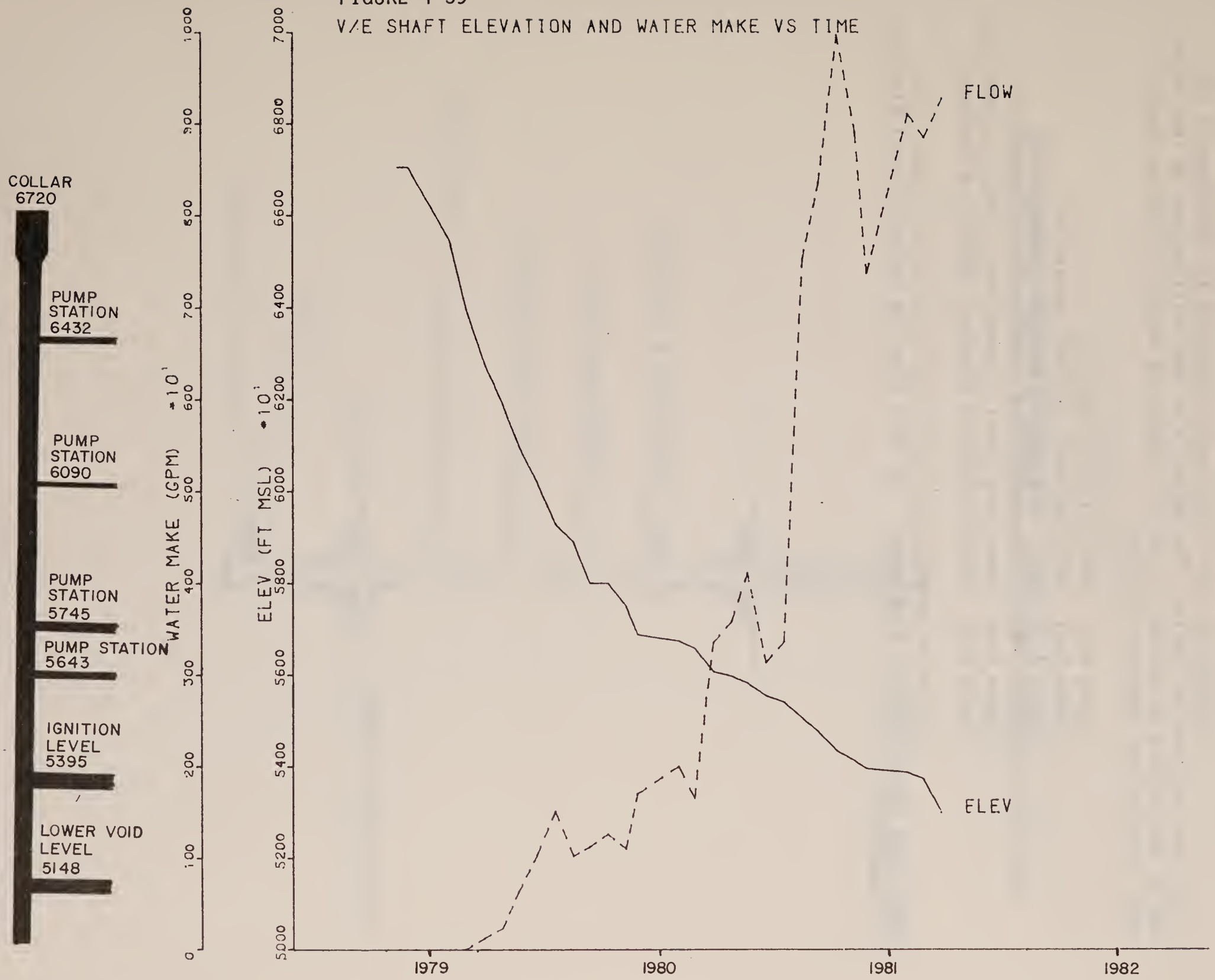


FIGURE 4-39

V/E SHAFT ELEVATION AND WATER MAKE VS TIME



4.4.5 Production/Service Shaft Station Development

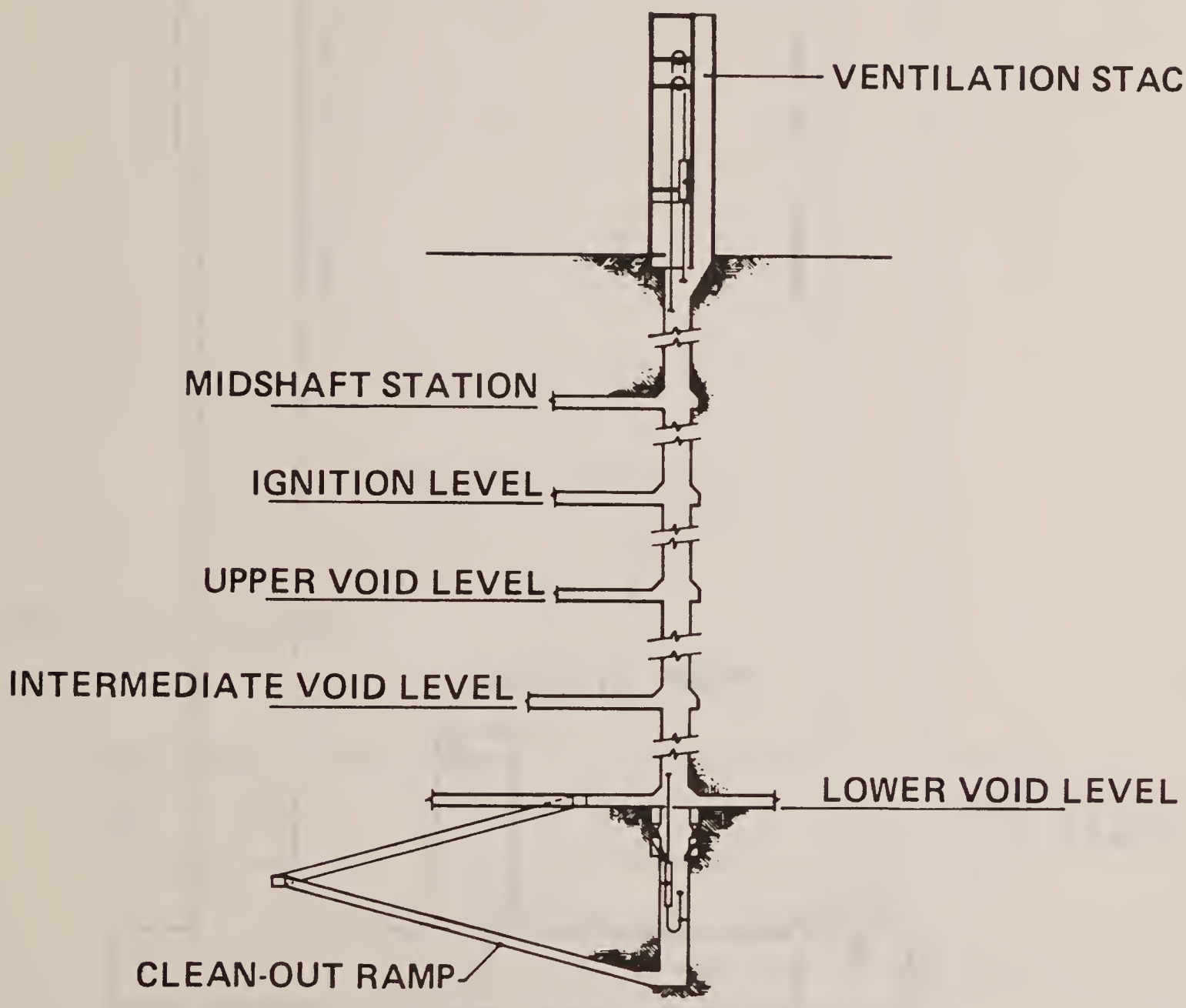
Stations on four levels were completed to interconnect the Production and Service Shafts. The majority of the drifting was 20 feet high and 30 feet wide with smaller drifts for sumps and water collection areas. These stations are shown as follows:

Figure 4-40 Vertical Cross Section
Figure 4-41 Ignition Level (5647-ft elevation)
Figure 4-42 Upper Void Level (5486-ft elevation)
Figure 4-43 Intermediate Void Level (5345-ft elevation)
Figure 4-44 Lower Void Level (Incomplete) (5208-ft elevation)
Figure 4-45 Midshaft Station (photos) (6095-ft elevation)

Station progress in the V/E shaft is shown on Figure 4-46, Upper Void Level (5395-ft elevation). At this time the Ignition Level Station is incomplete.

FIGURE 4-40

Production Shaft VERTICAL CROSS-SECTION



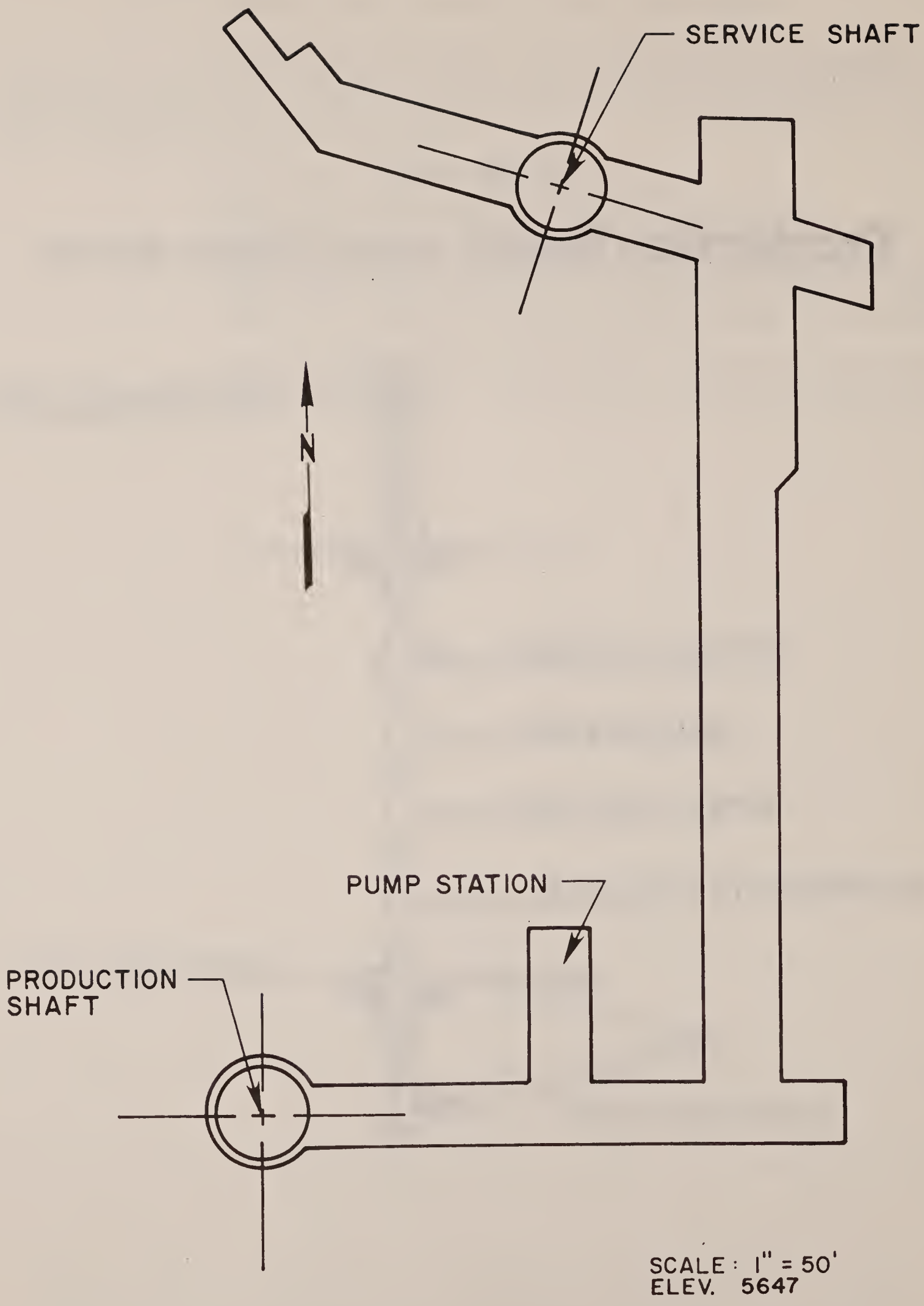


FIGURE 4-41
IGNITION LEVEL
SERVICE AND PRODUCTION SHAFTS

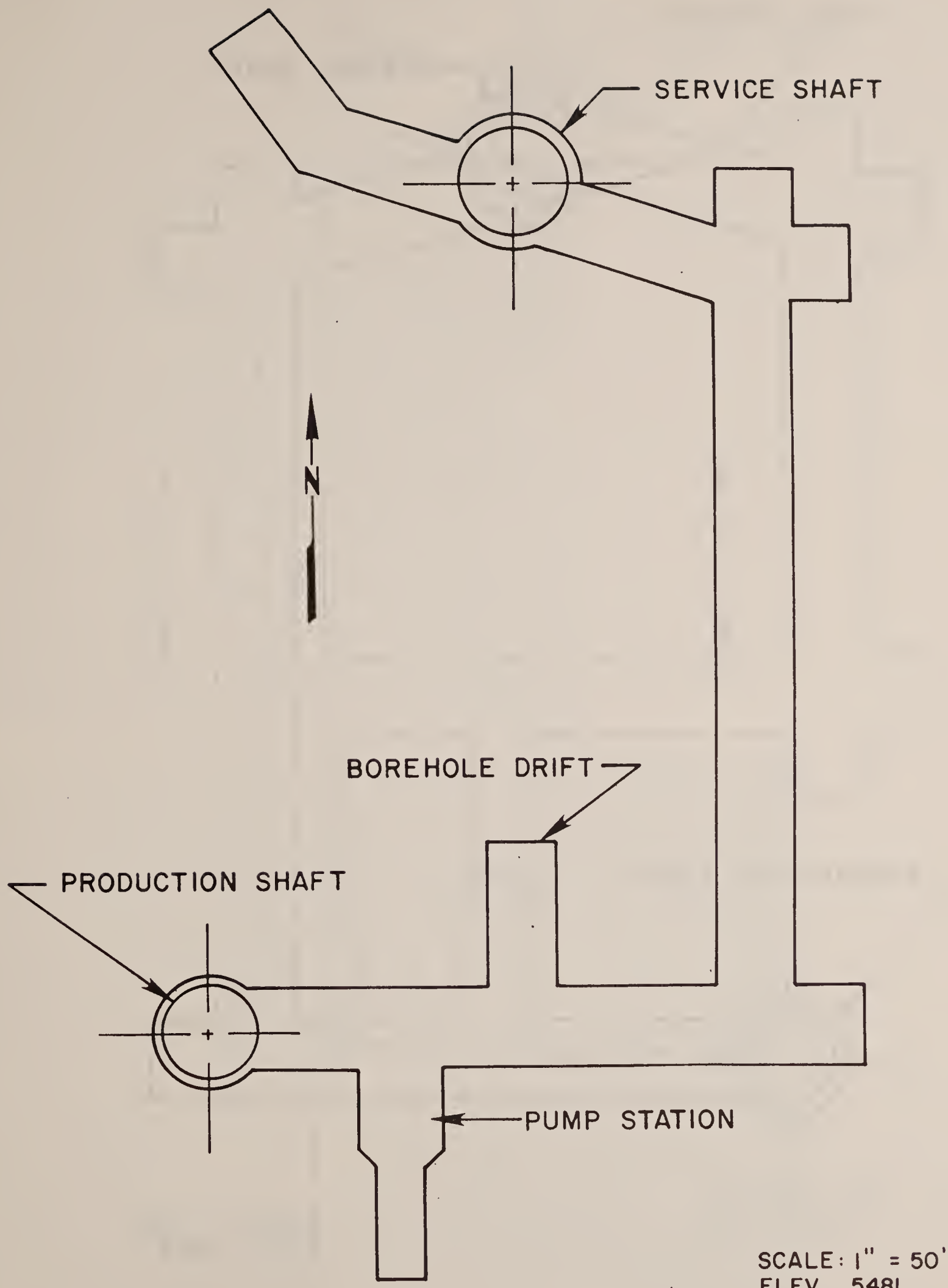


FIGURE 4-42
UPPER VOID LEVEL
SERVICE AND PRODUCTION SHAFTS

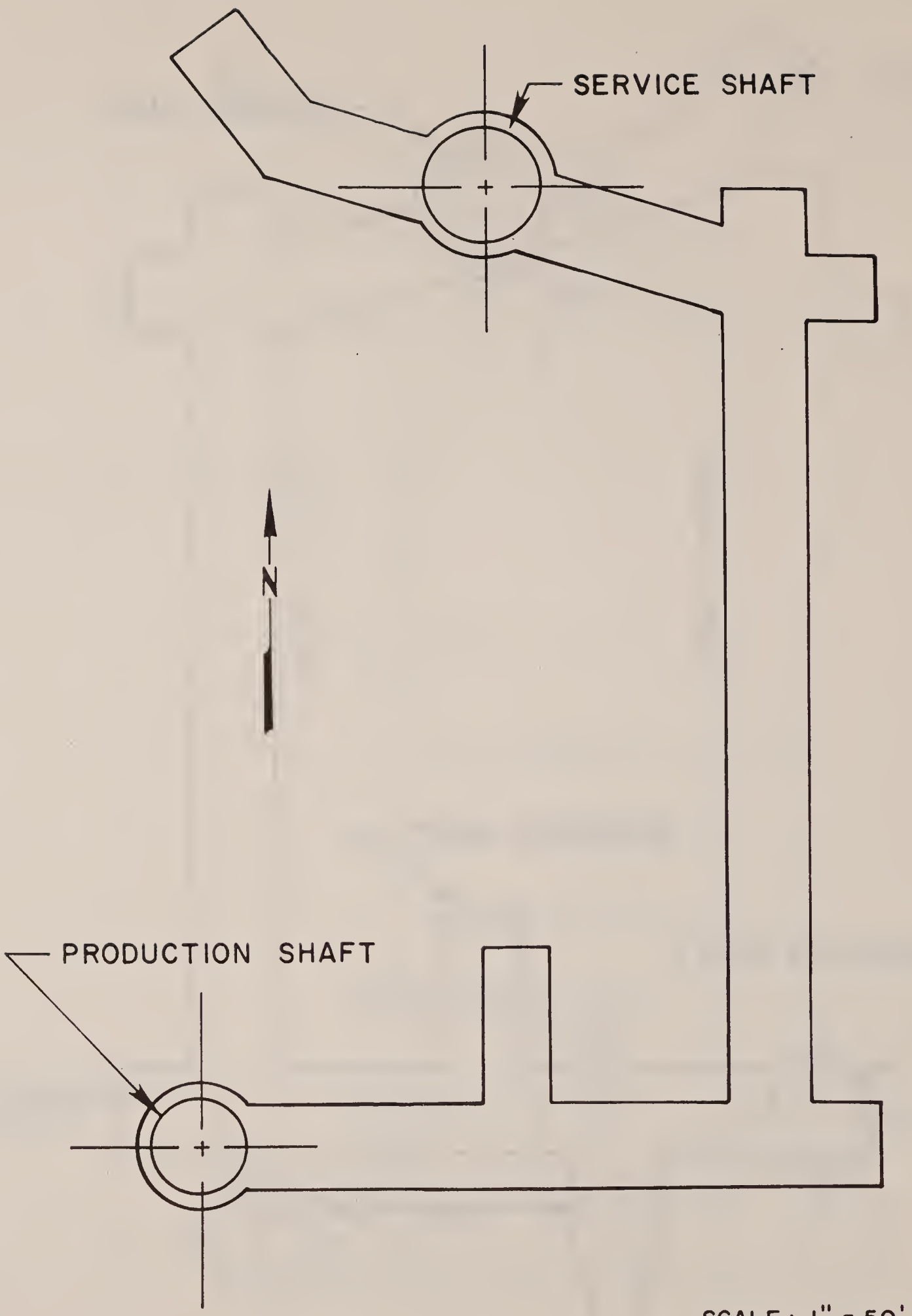


FIGURE 4-43
INTERMEDIATE VOID LEVEL
SERVICE AND PRODUCTION SHAFTS

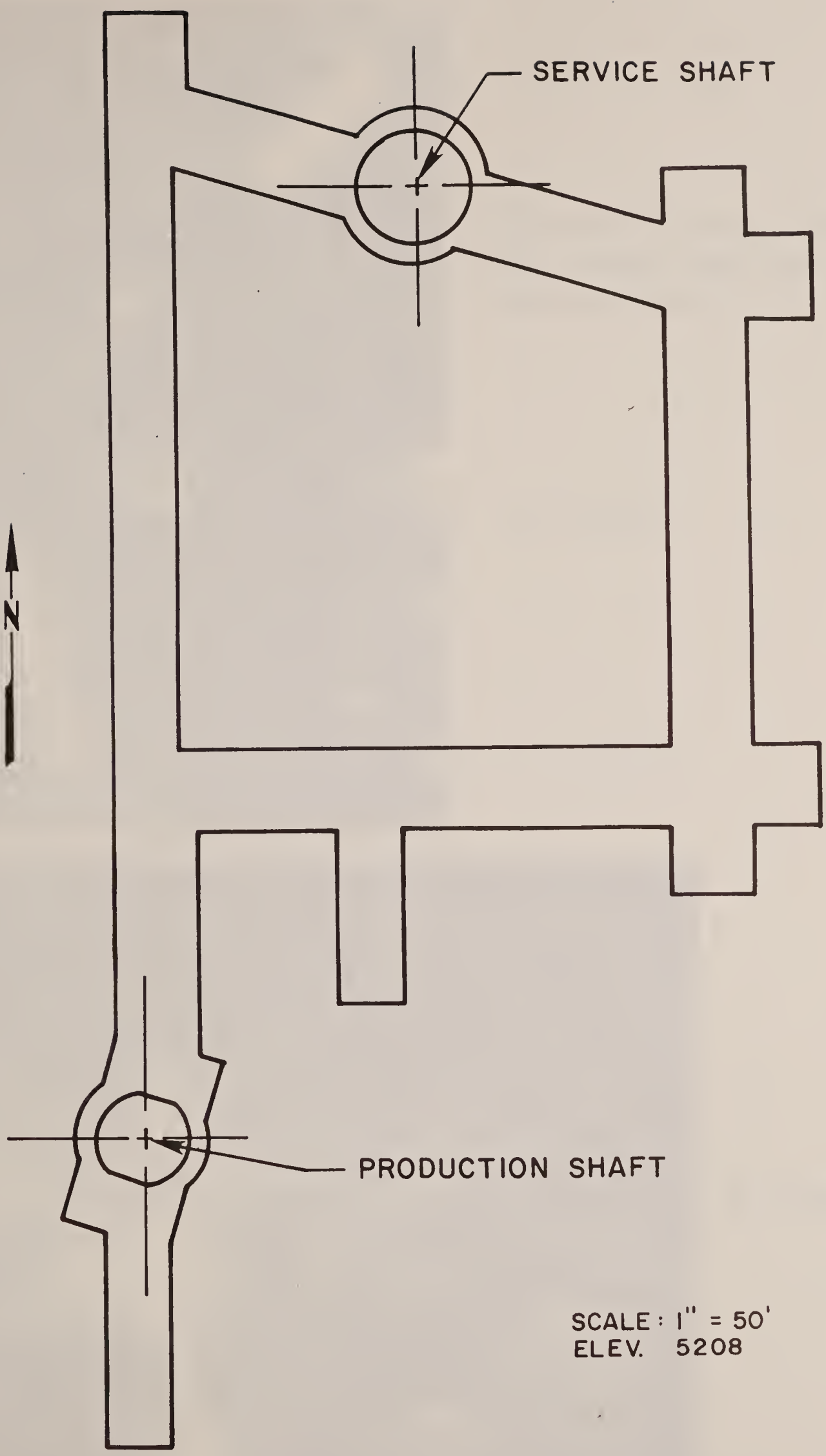


FIGURE 4-44
LOWER VOID LEVEL
SERVICE AND PRODUCTION SHAFTS

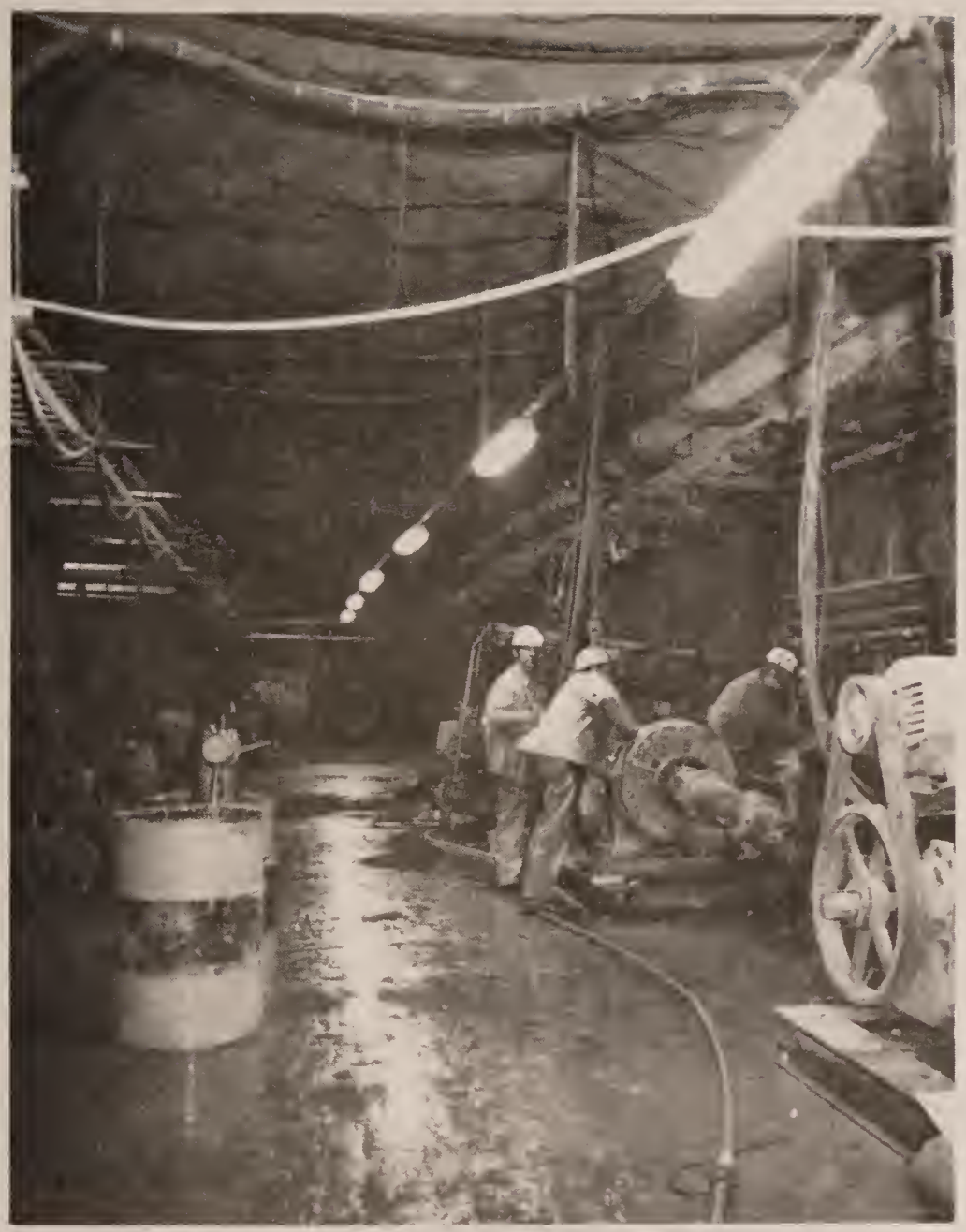


Figure 4-45 Mineshaft Station Drift Between Production and Service Shaft

a) One View

b) Second View

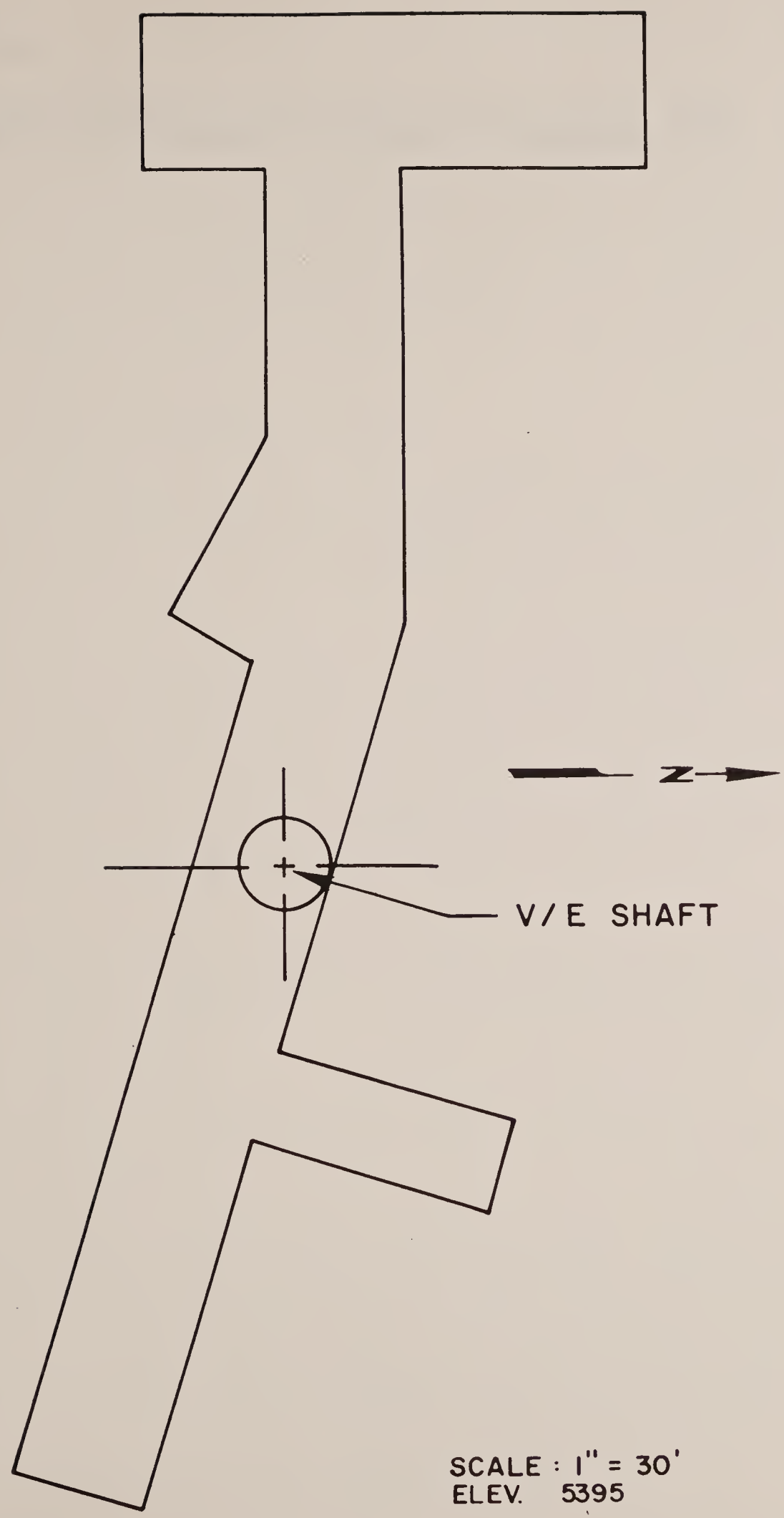


FIGURE 4-46
UPPER VOID LEVEL
VENTILATION / ESCAPE SHAFT

5.0 PROCESSING

No shale-oil processing facilities exist on the C-b Tract. Engineering studies related to processing are discussed in Section 4.1.13.

6.0 DISTURBED AND RECLAIMED AREAS

The number of disturbed and reclaimed acres in this year's report may differ from those in the reports of 1978 and 1979. Acreages listed in past year's reports were based on permitted acreages and estimates, whereas those for this year's report were taken from contour maps of the area derived from aerial photos taken during 1980. The disturbed and reclaimed acreage in this year's report are also closer to the actual acreage affected on tract. Areas of disturbance to date and the corresponding acreages are listed in Table 6-1. Figure 6-1 is a map depicting current disturbed acreage, with areas corresponding to those on Table 6-1.

6.1 Disturbed and Reclaimed Acreage

The number of additional acres disturbed during 1980 was 15.8. The areas disturbed are associated with the electrical power-line switchyard (6.1 acres), the sewage treatment site (1.7 acres), the continuation of the raw shale storage pile (5 acres), and the continuation of the topsoil stockpile south of the support area (3 acres).

Other areas of construction activity during 1980 were included in previously permitted and disturbed areas. These include the power line substation (included in the 101 permitted acres of the Mine Support area graded in 1978), the L'eau Claire Sand Filter (included in the 30.2 permitted acres of the irrigation system, disturbed in 1979), the Public Relations visitor-facility and helipad (one acre where the old guard house was located, disturbed in 1978) and the truck weighing scales (part of the three acres of the traffic control station and guard house area, disturbed in 1978).

The number of acres reclaimed during 1980 was 3.3. These areas include the enlargement of the topsoil stockpile south of the support area (3 acres) and the topsoil stockpile at the sewage treatment site (0.3 acres).

6.2 Overburden Storage

No overburden was mined or stored during 1980.

6.3 Shale Storage

Raw shale was placed on the storage pile in East No Name Gulch. The pile had an increase in size of five acres during 1980. The total amount of raw shale deposited during 1980 was 86,251 cubic yards (207,002 tons).

The total area of the storage pile is presently 11 acres. The storage pile presently contains 56,500 cubic yards of overburden and 86,551 cubic yards of raw shale.

6.4 Reclamation/Revegetation Status and Control

6.4.1 Graded Lands

Graded lands consist of areas that have been disturbed and are

TABLE 6-1

Estimates of Disturbed and Revegetated Acreage[1]

Disturbed Area[2]	Acreage Disturbed		Acreage Revegetated	
	Before 1980	During 1980	Before 1980	During 1980
1) Guard House & Truck Scale Area	3.4			
2) Sewage Treatment Plant & Road		1.4		
13) Topsoil Stockpile at site		0.3		0.3
3) Heliport & Public Relations Facility	0.6			
4) Main Access Road	23.5			
5) Ancillary Area	17.2			
6) Proposed Dame Site (East No Name)	1.2		1.2	
7) Switchyard Area & Access Road		6.1		
8) Explosive Storage Area	1.8			
9) Mine Support Area	72.2			
10) Raw Shale Storage Area	6.0	5.0		
11) Rock Stockpile Areas	7.7			
12) Topsoil Stockpiles (near Support Area)	5.5	3.0	5.5	3.0
13) Water Discharge & Application Area				
(Pond "C" Area)	3.7			
Irrigation System Pipelines[3]	4.0		4.0	
14) Abandoned Access Road	10.0		10.0	
TOTALS[4]	156.8	15.8	20.7	3.3

[1]Acreages revised from 1979 Annual Report based on aerial photos taken in 1980.

[2]Enumerated disturbed acreage in column corresponds to that shown on "C.B. Tract Disturbed Areas Map", Figure 6-1.

[3]Acreage is an estimate-did not come from aerial photos.

[4]Total acreage disturbed to date = 172.6

Total acreage revegetated to date = 24.0

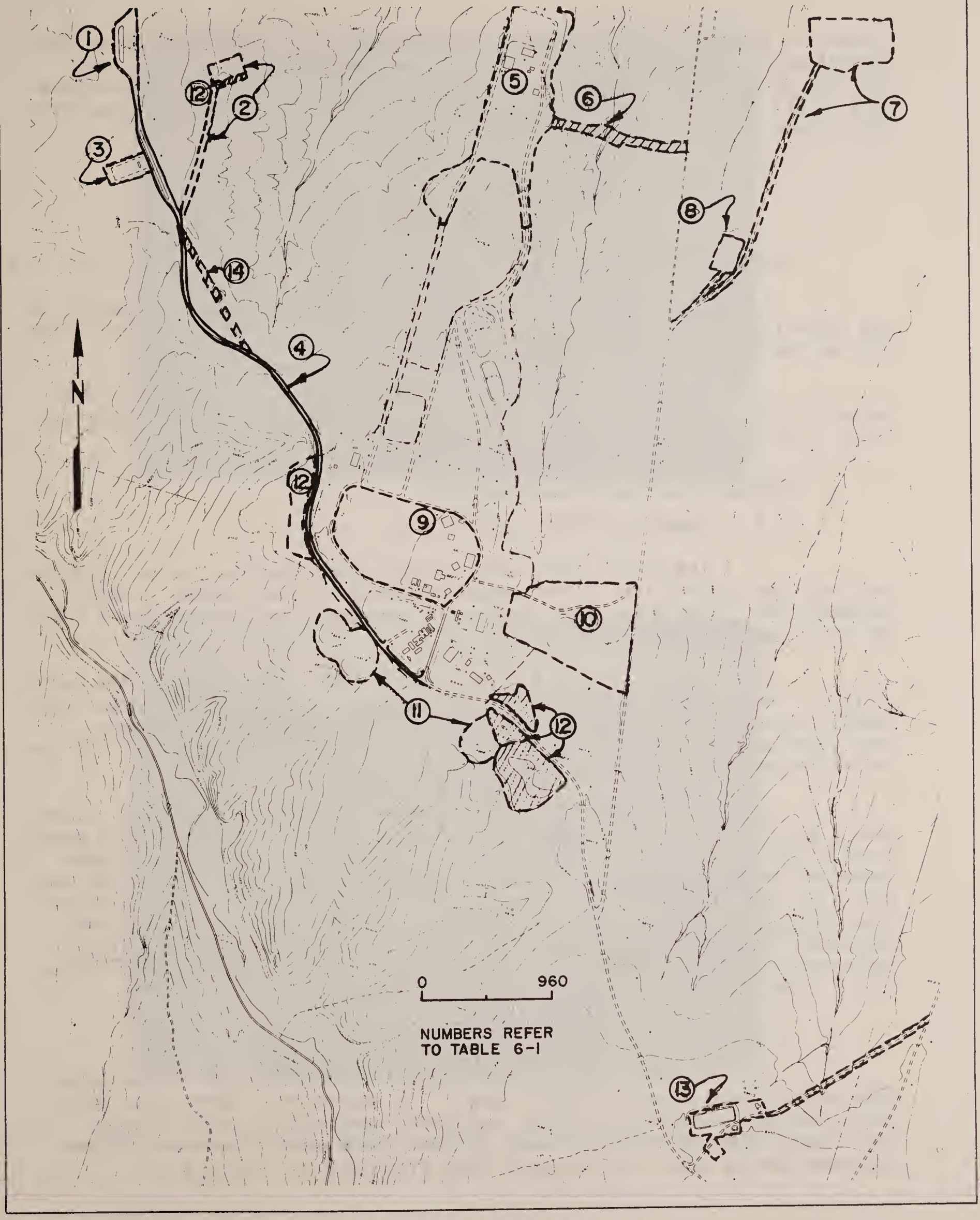


FIGURE 6-1. C-B TRACT DISTURBED AREAS MAP.

stabilized through the use of at least 50 percent rock in soil surface and are mechanically stabilized through the use of dust palliatives and water. In addition to the 122.4 acres graded in 1978 and 1979, the power line switchyard (6.1 acres) and the sewage treatment site (1.4 acres) are in a graded condition. This brings the total acreage graded to 129.9 acres.

6.4.2 Topsoil Replacement

No topsoil was replaced during 1980.

6.4.3 Revegetation

The areas that were revegetated in 1980 are the enlargement of the topsoil stockpile south of the support area (3 acres) and the topsoil stockpile at the sewage treatment site (0.3 acres).

As a measure of yearly revegetation progress Figures 6-2a through 6-2f show 6 years of such progress at the NQ-4 slant corehole site on-tract. This area has essentially been returned to its natural state.

6.5 Overburden and Topsoil Management

6.5.1 Vegetation Plantings/Mixtures

The topsoil pile south of the support area was seeded in October 1980. The topsoil pile at the sewage treatment site was seeded in early November 1980. Both areas were seeded with permanent seed mixture (Table 6-2) for north facing slopes.

Fertilizer was applied to areas which were seeded in the spring of 1978. These areas are the topsoil stockpile south of the support area, the topsoil stockpile west of the support area, and the abandoned access road. Fertilizer was applied at the rate of 100 lbs of available nitrogen and 100 lbs available phosphorus per acre. Fertilizer was applied in May 1980.

The revegetated areas which were evaluated during 1980 (in Volumes 2 and 2A) are the ones cited above which received fertilizer. Total mean cover in the herb layer was 25 percent and base soil 62.2 percent. The mean number of species per square meter was 6.12 ± 0.27. Mean total production was 86.9 g/m^2 (807 lbs/acre). The most prevalent species were intermediate wheatgrass (Agropyron intermedium), Russian thistle (Salsola iberica), pubescent wheatgrass (Agropyron pubescens), and western wheatgrass (Agropyron smithii). The results of the evaluation of the revegetated areas are presented in Tables A8.9.1-1 through A8.9.2-4 in the Appendix Volume of this Annual Report.

6.5.2 Associated Costs

The total costs associated with reclamation and revegetation amounted to approximately $7,000 in 1980. The breakdown of approximate costs are: seed and transplants, $2,250; equipment rental, $900; mulch, $2,000; fertilizer, $300; fence, $500; labor, $1,100. There were no purchases of new equipment during 1980. This reduced costs from those of last year.

a) 1975

b) 1976

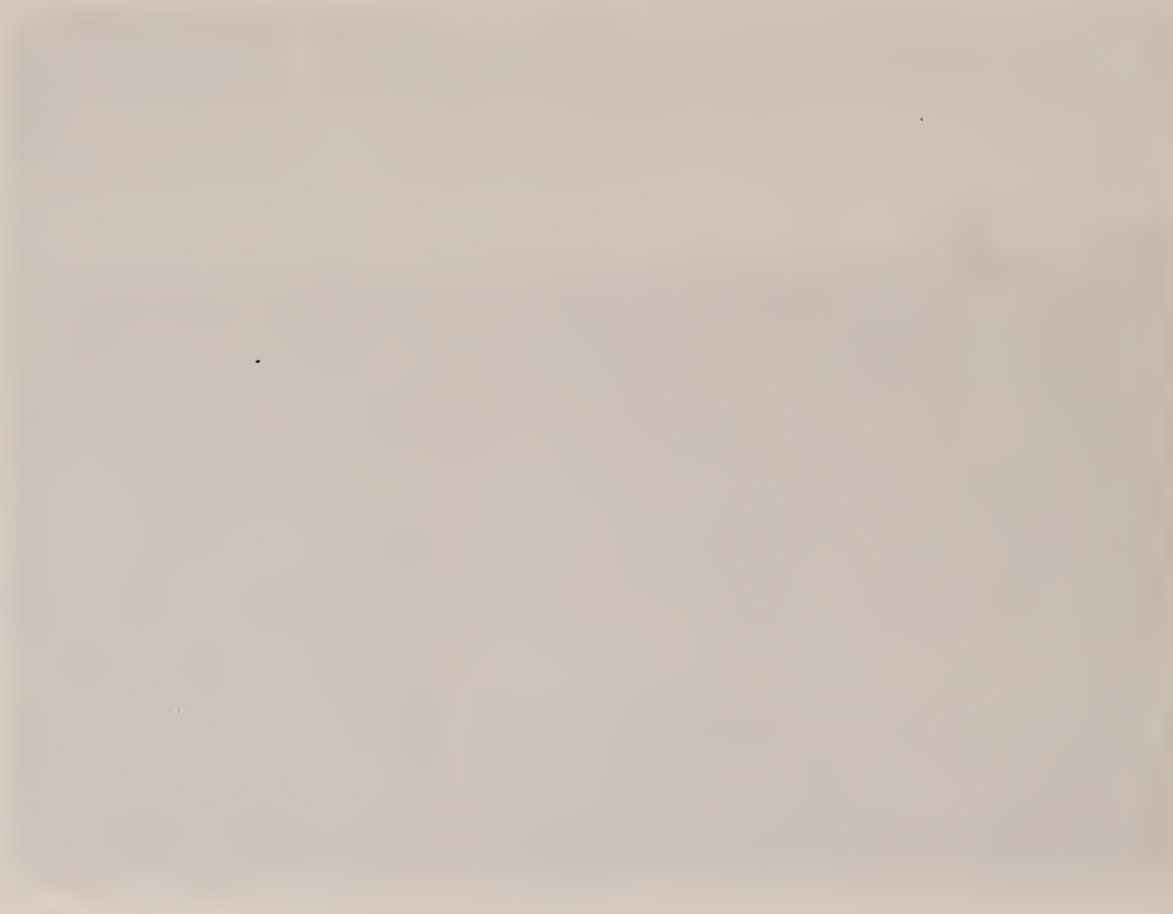
Figure 6-2 Revegetation Progress at the NQ-4 Slant Corehole Site

c) 1977

d) 1978

Figure 6-2 (Continued)

Revegetation Progress at the NQ-4 Slant Corehole Site



e) 1979

f) 1980

Figure 6-2 (Continued)

Revegetation Progress at the NQ-4 Slant Corehole Site

TABLE 6-2

Species List for C.B. Reclamation

Species:		Lbs/Acre Drilled: North & East and Level Areas	Lbs/Acre Drilled: South & West Areas
Grasses:			
*Agrophyron cristatum	- crested wheatgrass	1	1
*A. elongatum	- tall wheatgrass	-	1
*A. spicatum var. inerme	- beardless bluebunch wheatgrass	2	2
*A. smithii (rosana)	- western wheatgrass	1	2
*A. intermedium (amur)	- intermediate wheatgrass	1	2
*Bromus marginatus	- mountain brome	1	-
*Elymus cinereus	- Great Basin wildrye	1	-
*E. junceus	- Russian wildrye	1	1/2
*Festuca ovina	- hard sheep fescue	1	-
*Oryzopsis hymenoides	- Indian ricegrass	-	1
Forbs:			
*Hedysarum boreale (Utah)	- Utah sweetvetch	1/2	1/2
*Medicago sativa	- alfalfa	1	1/2
*Penstemon sp.	- penstemon	1/2	1/2
Shrubs:			
+Amelanchier spp.	- serviceberry	-	-
*+Artemisia tridentata	- big sagebrush	1/2	-
*Atriplex canescens	- four wing saltbrush	-	2
*A. confertifolia	- shadscale	-	1
*+Cercocarpus montanus	- mountain mahogany	1	1/2
*Cowania mexicana	- stansberry cliffrose	1	1/2
*Eurotia lanata	- winterfat	-	1
*+Purshia tridentata	- bitterbrush	1	1/2
+Symphoricarpos oreophilus	- snowberry		
Trees:			
+Juniperus osteosperma	- Utah juniper		
+J. scopulorum	- Rocky Mountain juniper		
+Pinus edulis	- pinyon pine		
	TOTAL	13 1/2 Lbs/Acre	15 1/2 Lbs/Acre

*Seed (P.L.S. - Pure Live Seed)
+Transplants (40 per acre) will be placed selectively in areas of suitability; (North, East, and level areas), transplants will total 320 per acre.

Note: Forbs will be innoculated with Northrup King innocular.

7.0 ENVIRONMENTAL PROTECTION AND CONTROL

7.1 Air Pollution Control

Principle activities in 1980 with the potential to affect air quality included the sinking of the Production, Service, and V/E shafts, truck transport along haul roads, operation of the batch plant and continued construction of upper ponds.

Comparisons of air monitoring measurements with ambient air quality standards are made in Volume 2 of this Annual Report.

C.B. holds a valid Prevention-of-Significant-Deterioration (PSD) Permit for the Ancillary Phase (defined in 1977 as up to 5000 barrels/day normally) from the EPA and a valid Fugitive Dust Permit from the State of Colorado Air Pollution Control Division. In April 1981 a PSD permit application for commercial operations will be submitted to the EPA.

Two air pollution control "systems" are in operation at the C-b Tract: baghouses on the concrete plant which were described in last year's Annual Report, and applications of water and dust palliatives on unpaved roads. Emissions from temporary power generators are uncontrolled; controls are not required, as they are below the horsepower level requiring controls.

The C.B. Project obtained a Fugitive Dust Permit (C-11,454(FD)) from the Colorado Air Pollution Control Division on August 30, 1977. Pursuant to this permit, C.B. paved the major access road to the Tract. This work was completed in August of 1978. PSD and Fugitive Dust Permits require dust control on haul roads by regular applications of water and dust palliatives. The PSD Permit requires quarterly reports to the EPA regarding both total water used and the amount and type of dust palliative applied. Water has been applied to the haul roads, on an as-needed basis; dust palliatives have been applied during 1980. The applications of both water and dust palliatives are indicated in Tables 4-4 and 4-5.

As one control measure to reduce vehicular traffic, the busing system instituted in 1978 continued to be used in 1980; approximately 60% of the Tract personnel rode the buses in 1980.

7.2 Water Management System

Principle activities in 1980 with the potential to affect water quality included the sinking of the Production, Service, and V/E shafts with their attendant dewatering requirements. Thus in 1980 the project continued to be in a water-surplus mode. C.B. holds a valid National-Pollutant-Discharge-Elimination-System (NPDES) Permit to discharge these excess waters into Piceance Creek via East No Name Gulch.

The water handling and treatment system consists of a series of holding ponds, a test reinjection well, a land application system, and discharge to No Name Gulch. Water from the mine shafts first enters two five acre-feet capacity ponds, designated A and B. Their functions are primary settling of

suspended solids and control of pH level so as to achieve that water quality level required by the NPDES permit. From Pond B the water may go directly to this surface discharge or to another holding pond, Pond C. Pond C is above the grade of Pond B and the water is pumped via the pumphouse as shown on Figure 4-22 to Pond C. Pond C has a five acre-foot capacity and serves as site for both further settling of suspended solids and as a surge pond for the land application system or for reinjection. From Pond C, water can be pumped to both of these systems simultaneously. The planned reinjection system is designed to eventually handle up to 2200 gpm (Reinjection Application Section 10.8). Water pumped from Pond C to the reinjection system is filtered through a L'eau Claire sand filter, deoxygenated and treated with biocides prior to injection to improve its quality. Water sent to the land application system passes directly from Pond C into a sprinkler system. The land application system is currently designed to handle 440 gpm over 100 acres on a continuous basis and controlled such that water is not applied beyond the field capacity of the land.

In April, the installation of an acid storage tank and piping to Ponds A and B was completed and put into use as our primary means of adjusting the pH of the mine water.

Also during April, baffles were installed in Ponds A and B to increase the retention time and travel length through the ponds in an effort to decrease the total suspended solids of the discharged water. Flocculants are also used in this regard.

The gland seal pumps, located in the lower pond pump house, were started in May and have been in continuous operation for the remainder of the year. They provide drilling water and gland seal water for pumps in all three shafts.

Chemical coagulants and flocculants were tested in June. Good results were obtained using Magnaflox charged polymers and the construction of a permanent flocculant addition system was completed in November. This facility is located at Pond A and contains two 500-gallon mixing tanks and metering pumps with piping to Ponds A and B.

Testing the sprinkler system began the end of May. After testing, the system remained in operation until the middle of October. About 440 gpm was pumped through two nozzles for a total of 39,313,650 gallons for 1980, averaging 8.5 acre-inches per acre.

A total of 509,000,000 gallons from all three shafts had to be treated and disposed of by usage, discharge, or land application during 1980.

A complete breakdown of the tract water usage is given in Table 4-4.

NPDES discharge of mine water is continuing in accord with requested permit criteria revision (letter submitted 10/19/80 to State of Colorado Water Quality Control Commission) requiring change on the basis of an Agricultural stream use-classification for Piceance Creek. Meanwhile, the existing permit which would have expired December 31, 1980 has been temporarily extended for two years without change or response to C.B.'s requests to the Water Quality Control

Commission for change. High values for fluoride have continued throughout 1980 and have been regularly reported to the Colorado Water Quality Control Division. There have been no exceedances of recommended in-stream criteria for fish and wildlife.

Regarding water storage, alternative plans presently under consideration include:

1. Willow Creek, utilizing a reservoir in Upper Willow Creek fed by runoff diversions from Willow and Hunter Creek.
2. White River Study, a cooperative study to develop a preliminary plan for a multi-purpose water storage and delivery system serving that portion of the White River Basin which lies within the State of Colorado.

7.3 Water Augmentation

C.B. has a Water Augmentation Plan as required by the Water Court, District No. 5, of the State of Colorado (Case No. W-3493 and others). This conditional decree covers C.B. water rights for "dewatering, monitoring, industrial, mining, retorting, refining, manufacturing, stream flow augmentation, providing of replacement waters, substitute supply, reinjection, dust control, land reclamation, irrigation, land application, domestic and all other beneficial uses, either by direct diversion and application or by storage (directly or by exchange into facilities in which Applicant or its successors in interest then have the right to store water) and by subsequent application or by exchange. . ." Under this Plan, monthly water use reports are submitted to the State Engineer. See Table 4-4 for this information. Also an increased water monitoring program over that required by the lease was required by the Water Court to be in operation in August 1979. This decree calls for the following additional stations over those monitored under the lease:

27 wells
10 springs and seeps
4 USGS streamgauging stations
7 precipitation stations.

Locations of these stations and monitoring frequencies are given in Volume 2 of this Annual Report. The principle purpose of this monitoring system is to detect changes in water levels in the wells and changes in flow of springs and surface streams in the vicinity of the Tract related to dewatering of the mine.

To the present time no water augmentation by C.B. has been required by the State Engineer.

7.4 Oil and Hazardous Materials and Their Spill Contingency

An updated Spill Prevention Control and Counter-Measure Plan is currently under revision. It includes a description of the potential for accidental spills or release of oil and other hazardous materials as a result of the Lessee's development of the Tract and associated off-Tract pipelines and terminals. This plan summarizes the potential sources of accidental spills, reviews the current regulations and standards that would apply to the Lessee's activities, defines and inventories the hazardous materials within the plant, and presents the Lessee's spill prevention, control, and contingency plans for the plant and associated pipelines.

7.4.1 Summary of Potential and Actual Spills During Construction

During construction activities, spills of diesel fuels and other fuels and lubricants are possible during transportation, loading and unloading operations, both on-Tract and at construction staging areas and rail spurs. Dust suppressants and smaller amounts of miscellaneous chemicals used during construction activities also pose pollution threats if quantities of these materials reach drainages or flowing streams near the Tract. The trucking, loading, and unloading of hazardous supplies during construction is a potential source of accidental spills. All transformers on Tract were examined for PCB's and found to be negative.

There were no major spills requiring reporting or activities of the spill contingency plan during the year. There were four minor spills involving gasoline and diesel fuel on or near the Tract in 1980. All of the spills were contained immediately and cleaned up, thereby presenting no danger to personnel or to the environment. The cleanup procedure consisted of covering the spills with sand to soak up the fuel. The contaminated soil was removed and new soil was then deposited.

7.2.4 Oil and Hazardous Materials Inventory

A list of substances expected to be present in substantial quantities within the shale oil plant for commercial operations is presented on Table 7-1 and compared with that existing in 1980. The list identifies those both on and off-Tract which would be classed as pollutants if allowed to escape. With regard to oily sludge, it is anticipated that it will be produced in small enough quantities that no storage need be provided and that it is of such nature that it can be cycled into conceptual surface retorting facilities.

7.4.3 Notification Under the Response Plan

In the event of an accidental spill of oil or other hazardous material reaching or having the potential of reaching a waterway, various government entities must be notified as follows:

Notification	Spills Situation
EPA, Region VIII and Colorado Department of Health	Spills on or near Tract
U.S. Coast Guard, 2nd District	Pipeline or transportation-related
Colorado Division of Wildlife	Danger to fish, etc., in surface waters
Water Quality Control Division, Colorado Department of Health	Contamination of water supplies
Colorado Highway Department	Move vehicles, control traffic
OSO	All spills

TABLE 7-1

Oil and Hazardous Materials Inventory

Material Stored	Commercial Operations Storage Capacity BBL	1979 Storage BBL	1980 Storage BBL
On-Tract			
Process Retort Water Stripper Feed	60,000	0	0
Process Condensate Water Stripper Feed	80,000	0	0
Plasticrete	100	50	50
Diesel Fuel	4,000	830	2,950
Gasoline	1,000	35	645
Chlorine	50	10	10
Oil-Water Separator Liquid	1,000	0	0
LPG	1,000	190	850
Ammonia	13,000	0	0
Shale Oil	350,000	0	0
Sulfuric Acid	100	30	100
Off-Tract			
Ammonia	1,500	0	0

Notification	Spills Situation
BLM, USFS	Certain spills
Local city, fire, police, health departments	Major spills

7.4.4 Spill Response Team

All spills not involving the product oil pipeline will be responded to by an in-plant spill response team which will be specially organized and trained for this purpose. A Spill Response Coordinator (SRC) will have the primary responsibility for deciding the action required and assembling the necessary team elements.

The following is a list of Spill Response Team Members:

Spill Response Coordinator	W. D. Langford
Cleanup Coordinator	S. L. Stringer
Government Liaison Coordinator	E. B. Baker
Public Relations Coordinator	S. McClain
Legal Coordinator	J. D. Steelman
Environmental Protection Coordinator	E. B. Baker
Procurement and Logistics Coordinator	G. Jay
Document Coordinator	T. H. Pysto
Accounting Coordinator	L. G. Barth
Training Coordinator	J. C. Leinberger
Safety and Security Coordinator	D. I. McClung

7.5 Waste Disposal

Sewage sludge and gray water (approximately 40,000 gal/week) from the Gilbert changehouse was hauled from the Tract to an approved dumping site. Solid waste (trash) accumulated in waste bins was trucked off-site as frequently as necessary to approved land fills; total amount for 1980 was 3,600 cubic yards. Metal scrap is accumulated in a scrap trailer and sold for recycling. A 9000 gallon-per-day sewage treatment facility to be completed in January 1981 is discussed in Section 4.3.4.

7.6 Erosion Control

The six sediment basins on C-b were cleaned and maintained in 1980. Because construction was limited, no new basins were constructed. Refer to Figure 7-1 of last year's Annual Report for typical design and Figure 4-1 of that report for locations.

7.7 Historic, Scientific, and Aesthetic Values Protection

As part of the Lessee's plan to protect these assets, archaeological and scenic-value studies have been undertaken on the Tract and surrounding area and reported in prior years; no new studies were conducted in 1980. During construction no significant findings have occurred.

Where possible, disturbance is minimized; and stockpiles are contoured and seeded to blend with surrounding habitat.

7.8 Noise Control

Occupational noise control for employee protection is accomplished where feasible by equipment design. When this approach is not feasible, or when engineering design does not reduce noise levels below the maximum allowable limit, all exposed persons are required to wear ear protection.

Monitoring of environmental noise and its compliance is discussed in Volume 2.

7.9 Health, Safety and Security

7.9.1 Program and Services

All levels of C.B. management have made a complete commitment to employee protection. Various contractors on site conduct regular safety meetings for their employees with the active participation of the C.B. Safety Department. New employees are required to receive health and safety training prior to being assigned work duties.

Presently on site, C.B. has a Health/Safety/Security Supervisor, two safety inspectors, a Security Supervisor, ten Security Guards, one Industrial Hygiene Technician and one secretary. Two major contractors also have full-time safety personnel.

The Health Department consists of a Grand-Junction-based Industrial Hygienist and one full-time C.B. Industrial Hygiene Technician. An Industrial Health Coordinator was selected and spends 25% of her time at the C.B. Tract.

Emergency medical service is provided twenty-four hours a day by one paramedic and eleven emergency medical technicians (EMT's). A fully equipped ambulance is available for off-site and C.B. Tract emergency medical treatment. An on-going EMT training program has been established with the assistance of Occidental physician advisors for the emergency medical personnel on the C.B. jobsite. Part of the EMT/paramedic training program consists of monthly training sessions with demonstrations and shaft extrication classes.

An EMT Coordinator was selected and is monitoring the First Aid Trailer, ambulance, all medical supplies and equipment and assisting with the EMT training.

St. Mary's Air Helicopter is available for extreme medical emergencies twenty-four hours a day. Occidental obtained a Long Ranger Helicopter in February, 1980, which is available for backup emergency medical transportation.

The C.B. Security Manual was completed during 1980, and an Industrial Hygiene and Safety Manual will be completed in 1981.

7.9.1.1 Manhours/Accident Frequency Rate

Following are figures depicting the manhours and accident frequency rate for the year 1980 at C-b Tract:

	Manhours	Reportable Accidents YTD	Lost Time Accidents YTD	Incident* Rate YTD
Occidental	182,617.5	3	2	3.29
Contractors	601,253	17	13	5.65
TOTAL	783,870.5	20	15	5.10 (1.91 for 1979)

* IR = Incident Rate =

7.9.1.2 Inspections and Violations

Cathedral Bluffs had a total of 26 visitations by MSHA during the year 1980. Gilbert Corporation received 65 citations from MSHA all of which were abated. Ortloff Minerals, Colomacco Division, received a total of four citations all of which were abated. Cathedral Bluffs Shale Oil Company received a total of 62 citations all of which were abated.

OSO also performs inspections for Lease and DDP compliance and furnishes copies of them to the Project.

Colorado Division of Mines inspected the property six times this year resulting in the issuance of twenty citations, all of which were abated.

7.9.2 Possible Health Hazards

7.9.2.1 Dust

Dust is controlled on unpaved sections of roadways by the application of dust suppressant. Dust is controlled during rock drilling operations by the use of water. Although there have been no surveys conducted yet to determine full-shift employee exposure to dust, it is not anticipated that problems exist in this area. Respirators are provided for employee use when assigned to dusty areas both above ground and in the mine.

7.9.2.2 Noise

See Section 7.8.

7.9.2.3 Gas

The shafts were classed as gassy on 1/2/80 by MSHA.

The gas sampling program utilizes air sampling bags and analysis is performed on site by using a Hewlett Packard Gas Chromatograph. Samples are taken on a daily basis. Weekly averages of samples taken at the shaft collars are reported in Volume 2.

7.9.2.4 Explosives Handling and Storage

Explosives for mining and surface construction use are stored in remotely located surface magazines which meet the criteria of the appropriate regulatory agencies. Explosives handling and transportation from magazine to the work site are conducted only by experienced, trained workers. Damaged and outdated explosives are burned in a remote location on tract by the safety personnel under appropriate permit.

7.9.3 Fire Control

The fire control systems utilized at the C-b Tract include the following:

- Dry chemical hand-held and wheeled fire extinguishers for protecting all buildings, including hoist houses.

- A twin agent (dry chemical/water foam) trailer extinguisher for large fire protection.

- Rubber-tired water tanker trucks available for use in extinguishing brush fires that might develop on site.

Fire-control training has been provided for both surface and underground situations. A mine-rescue team exists on-site.

7.10 Fish and Wildlife Protection

7.10.1 Objectives

The Fish and Wildlife Protection Plan has been developed to provide procedures to avoid or minimize adverse effects on fish and wildlife caused by the development and operation of oil shale facilities on Tract C-b. The habitat management plan uses the baseline environmental data as a frame of reference. It delineates habitat losses that may occur and mitigation efforts needed either to replace in-kind or to improve alternative habitat for selected species of animals.

7.10.2 Estimated Access-Road Effects

It was previously estimated that the main access-road might impede deer movement through the pinyon-juniper vegetation type north of the Tract and that a major ecosystem impact might result from deer/vehicular collisions. Neither has proven to be the case. Deer still cross the road frequently; and no deer have been hit by vehicles along the main access from Piceance Creek Road to Tract C-b.

7.10.3 Mitigative Actions Taken in 1980

7.10.3.1 Brush Cutting

The sagebrush beating area (approximately 50 acres in Oldland Gulch and 50 acres in Gardenhire Gulch) was seeded with early spring grasses, forbes, and browse species. The area in Gardenhire Gulch was also harrowed after being seeded. Deer pellet group transects were established in both areas, as well as three transects outside of the affected areas which will be used as control transects. Lagomorph abundance will also be monitored on the same transects.

7.10.3.2 Land Application System

The land application system was in operation during the summer of 1980. The objective of the planned irrigation system is to provide a method of utilizing interim excess mining water during the summer months until such time as the water can be used for retort processing or for reinjection. The sprinkler system is a good mitigation project because the vegetation condition improves from the additional moisture. Permanent transects were established and include sampling for both deer and lagomorph pellet group densities, browse production and utilization, small mammal abundance and avifauna abundance. Results of this analysis are discussed in Volume 2.

7.10.4 Future Possible Mitigation Projects

Several mitigation projects have been proposed including: additional bush cuttings in selected draws; prescribed burnings and planting seedlings in chained areas; fencing for better cattle distribution; additional stock tanks and water wells; proposed dams for water storage which could create waterfowl wetlands and additional fishery habitat.

7.11 Off-Tract Corridors

The route for a 138 KV powerline corridor from Meeker to the Tract was discussed in Section 4.2.4 of last year's Annual Report. Final draft of the Environmental Assessment was completed in early 1980 and construction is now underway as indicated in Section 4.2.5 of this report.

7.12 Abandonment

The Abandonment Plan is contained in Supplemental Material to Detailed Development Plan Modifications submitted July, 1977. The plan is still valid. It will be updated with detailed specification for OSO approval prior to actual abandonment.

7.13 Permit Status

A C.B. permit status report of permits obtained to date is presented on Table 7.2.

TABLE 7-2

C-b Permit Status Report
Active Permits Received

Permit Title	Purpose	Permitting Agency	Permit No.	Date Submitted	Date Approved	Date of Expiration
Air						
1) PSD	For Ancillary Development	EPA		10/17/77	12/15/77	When ancillary phase is completed and commercial begins
2) Fugitive Dust Permit	Surface disturbance activities	CAQCD	C-11, 454 (FD)	6/27/77	12/28/77 Rev 8/5/80	Indefinite
3) Emission Permit	Concrete Batch Plant	CAQCD	C-11, 931-165	5/18/78	6/23/78	Indefinite
4) Open Burning Permit	Dynamite Disposal	CAQCD	860-0B-004	2/01/80	4/01/80	4/01/81
Water						
1) NPDES	Water Discharge to Piceance Creek	CWQCD	CO-0033961	8/19/77	3/27/79	12/31/82
2) SPCC	To comply with the Clean Water Act	CWQCD, AOSO, EPA		11/79	Regularly updated	Update required every 3 years
3) Underground Injection Permit	Mine Water Reinjection	CWQCD		3/28/79	8/23/79	
4) Piceance Creek Water Right C-b pipeline #1	Transport water from the creek to C-b	Water Court	W-3441	7/27/77	2/28/78	
5) Piceance Creek Water Right	Construction Water	Water Court		7/26/77	Not required	
6) Water Augmentation Plan	Depletion Mitigation	Water Court	W-3492	8/31/77	5/21/79	Project Life

TABLE 7-2

C-b Permit Status Report (Continued)
Active Permits Received

Permit Title	Purpose	Permitting Agency	Permit No.	Date Submitted	Date Approved	Date of Expiration
7) Water Storage Right	To store water in Scandard Gulch	Water Court	W-3874	8/31/77	4/27/79	
8) Water Storage Right	To store water in East No Name	Water Court		8/31/78	4/27/79	
9) White River Water Right Diversion and Storage	White River option agreement with White River resources for Piceance Creek Pipeline & Powell Park Reservoir	Water Court	W-225-77/ W-226-77	Appropriate Date-8/5/66 Decree Date - 6/14/73		
10) Well Permits (34)	Covers permits for 29 wells and 5 shafts filed under Augmentation Plan for any beneficial use.	State Engineer	W-3493	8/31/77	5/21/79	
11) Sewage Plant Site Approval	Sewage Plant	CWQCD	Site 2852	8/06/80	8/28/80	
12) Sewage Plant	Sewage Disposal	CWQCD	Site 2852	9/22/80	11/03/80	Indefinite
13) East No-Name Dam Permit	Dam Construction	Colo.Dept. of Natural Resources, State Eng.	C-1591		8/27/80	
Land						
1) Lease	Tract C-b Development	USGS/AOSO	C-20341		4/74	4/96
2) DDP & DDPM	Lease Compliance	USGS/AOSO	N/A	2/77	8/77	
3) Monument Peak Right-of-Way	Microwave Communications	BLM	C-25677	7/31/77	10/20/77	Indefinite

TABLE 7-2

C-b Permit Status Report (Continued)
Active Permits Received

Permit Title	Purpose	Permitting Agency	Permit No.	Date Submitted	Date Approved	Date of Expiration
4) Road Right-of-Way	Construct Access Road	BLM	C-15824 RW	9/13/77	1/24/78	Indefinite
5) Temporary Use permit	A-5-A Monitoring Wells	BLM	C-28390 TUP	6/18/79	7/23/79	7/22/80
6) Notice of Prospecting	Site preparation and shaft sinking activities	CMLRB		3/77	Not required	
7) Mine Land Reclamation Plan	Surface Disturbance reclamation	CMLRB	77-530	11/07/77	3/23/78	
8) Special Use Permit	Permanent Zoning	Rio Blanco		10/10/78		Indefinite
9) MLRB Plan	Sewer Plant Site	MLRB			8/28/80	Indefinite
Others						
1) FCC Licenses (3)	Microwave Communications	FCC	(15562-IP-67X) (15563-IP-67X) (15564-IP-67X)	5/31/77	8/02/77	8/02/80
2) Notice to FAA of Proposed Construction	Structures over 200 ft.	FAA		8/18/78	None Required	
3) Heliport Location	Heliport Construction	DOI/AOSO FAA		4/26/80	4/26/80	Indefinite
4) Radioactive Materials License	Operate neutron moisture probe for soil moisture monitoring spinkler plots.	Colo.Dept. Health	Colo 437-01	5/01/80	6/31/80	6/31/85

8.0 SOCIO-ECONOMIC ACTIVITIES

8.1 Work Force

During 1980, the on-site work force varied from a low of 260 to a high of 481. Figure 8-1 depicts the latest revised manpower projections through 1982 on the C.B. Project. Last year's year-end projection for 1980 was 450; thus the actual is 31 in excess of this. The year-end projection for 1981 is 363.

8.2 Population Buildup

At the present time the work force population is living in Meeker and Rifle (Colorado River Valley) in the similar proportions to those of last year: Meeker - 11%, Rifle - 67%, Colorado River Valley (other than Rifle) - 20%, Miscellaneous - 2%. The work force has indicated a definite preference for living in the Rifle and Colorado River Valley between Glenwood Springs and Parachute. The distribution of permanent work force is estimated in the future to be 60% in Rifle, 25% in Meeker, 10% in Silt and 5% in other locations. Population in Garfield and Rio Blanco Counties has increased 6.3% and 4.4% respectively from 1977 to 1980.

8.3 Transportation

Transportation in the form of 47-passenger bus coaches was initiated in 1979 from Rifle and Meeker to the C.B. Project. This fleet grew to five by December, 1979. At 1980 year-end the fleet-size was seven, with four routed to Rifle, one to Meeker and two stand-by's. This service is provided on a seven day-a-week, three-shifts-a-day basis. During 1980, 5,028,500 passenger miles were accumulated in providing transportation to the project work force which averaged out to 25.0 passengers per trip to Rifle and 8.9 to Meeker; approximately 60% of the work force utilized these buses.

8.4 Housing

The total number of housing units for use by C.B. Project employees in Rifle and Meeker remained the same in 1980 as they were in 1979. There are 41 apartment units in Rifle, 10 townhouse units in Rifle, and a 103-space mobile-home park in Rifle. In Meeker, the project has 48 two-bedroom apartments for use by Tract employees.

In 1979 and 1980 the housing demands (dwelling units) resulting from project operation are as follows:

Year	Rifle	Meeker	Silt	Others
1979	235	95	40	20
1980	290	120	50	25

8.5 Mitigation Task Force Support

The Mitigation Task Forces in Rio Blanco County and Garfield County are important mechanisms for managing socio-economic impacts. An additional

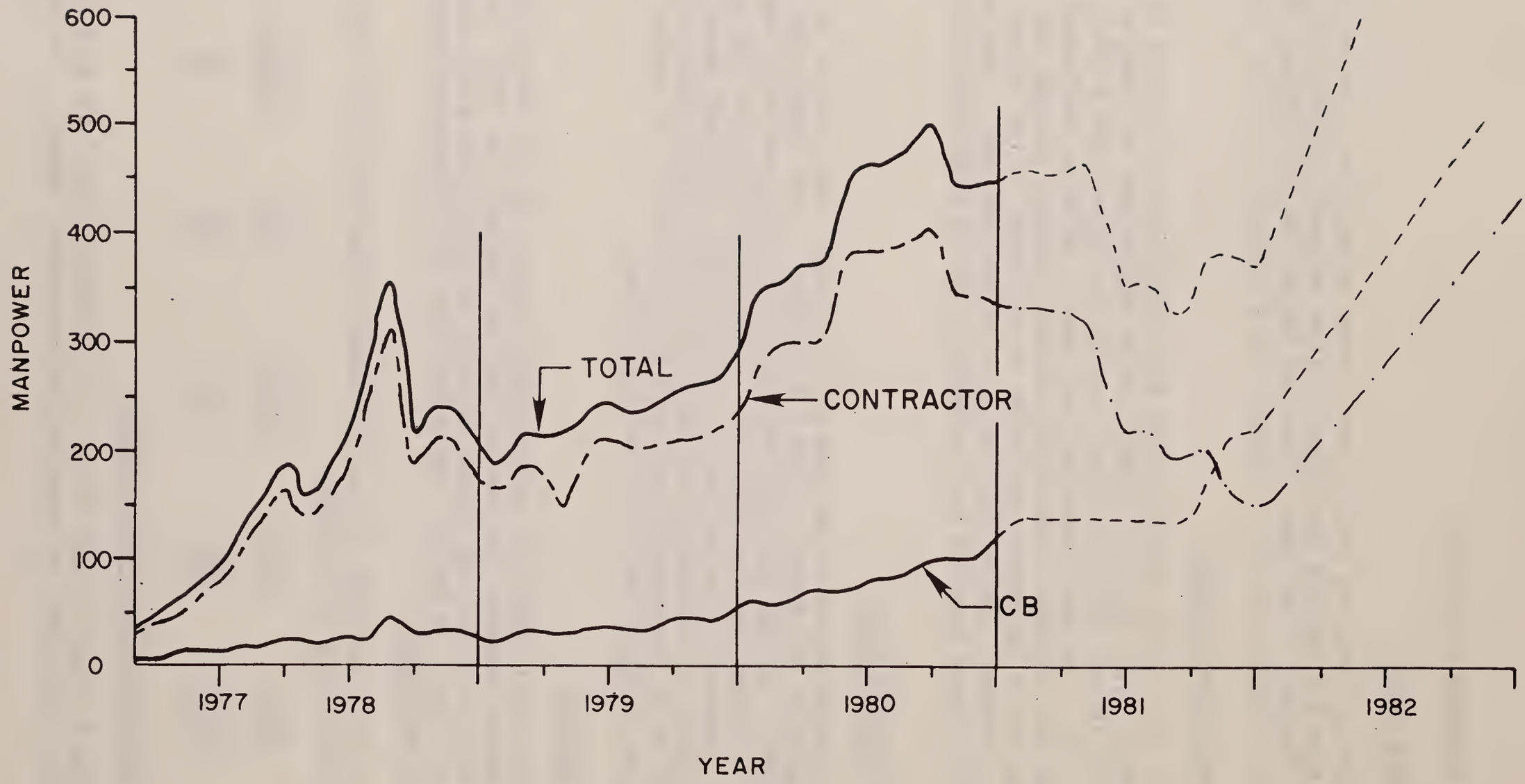


FIGURE 8-1
ACTUAL C-b MANPOWER THRU 1980,
PROJECTED THRU 1982

task force has recently been formed in Mesa County. Recent professional assistance provided to local projects by C.B. has included a recreation master plan, a low-income housing project, planning for hospital expansion, financing for library and senior citizen programs and numerous grant proposals.

8.6 Worker Programs and Monitoring

The C.B. Project funded throughout 1980 a monitoring program by their consultants that provided information regarding location of domicile, numbers in family, permanent residents, school age children, etc., and published this information on a semi-annual basis for use by local communities and school districts. This effort of providing socio-economic data to the local communities is an ongoing one which was continued throughout 1980 and during the construction period of the C.B. Project. This type of information will assist the local communities by providing the backup information necessary for grant applications, service expansion, etc.

8.7 Community Donations

During 1980, the C.B. Project responded by making donations to several groups in Meeker and Rifle. Some of the groups that received funds during 1980 were: the Chamber of Commerce in both Meeker and Rifle, women's and men's softball teams, several youth organizations, Upper Colorado Environmental Plant Center, Garfield Youth Services, Rifle and Meeker 4-H Programs, White River National Forest Association, Meeker OTA Baseball, Meeker Community Concert, as well as several civic organizations in both Meeker and Rifle.

8.8 Public Relations

8.8.1 C-b Tract Tours

During 1980, Public Relations conducted 168 tours at the Tract. Of these, 38 were government-related tours and 10 were news-media-related tours. There were a total of 1482 visitors involved with these tours. This represents a 44% increase in the number of tours compared to 1979.

8.8.2 Lectures, Presentations, and Expositions

A total of 116 lectures and/or presentations were made by various members of the public relations staff during 1980. In addition, there were six expositions in which models of the Tract were displayed. The new public relations facility utilized for these presentations is shown on Figure 8-2.

8.8.3 Photography

The chronological historical file of 35 mm color slides compiled last year was expanded to include 1980 photo records. In addition, Public Relations assisted several magazine and/or film crews with C-b Tract Photography. Some of these included National Geographic, Geo Magazine, Fireline Productions, NBC-TV News, ABC-TV News, CBS-TV News, Public Service Company of Colorado, the U.S. Department of the Interior and the U.S. Department of Energy.

8.8.4 Brochures and Public Information

Two color books, Shale Oil and Western Colorado, Rifle/Meeker, were made available for public information. Fact sheets on various activities at the Tract were also made available through the Public Relation's "public information package".

Figure 8-2 Public Relations Facility (May 1980)

9.0 ENVIRONMENTAL MONITORING

9.1 Scope

The Environmental Baseline Period for Oil Shale Tract C-b covered the period from November 1, 1974, to October 31, 1976. Results have been reported in nine Quarterly Data Reports, eight Quarterly Summary Reports, C-b Annual Summary and Trends Report (1976), and a 5-volume Environmental Baseline Program Final Report (1977), all submitted to the Oil Shale Supervisor.

From November 1, 1976 through August 31, 1977, the C-b Tract was under a period of suspension of the Federal Oil Shale Lease. The monitoring conducted during this period was executed under a program known as the Interim Monitoring Phase. Environmental data for this time period were submitted to the Oil Shale Office (OSO) on October 14, 1977 (Interim Monitoring Report #1). The Interim Monitoring Period was later extended by the OSO to cover the period from September 1, 1977 through March 31, 1978. Data for this time period were submitted to the OSO on May 15, 1978 (Interim Monitoring Report #2). The Development Monitoring Program was initiated in April 1978. The Development Monitoring Program for Oil Shale Tract C-b was submitted to the OSO in a document dated February 23, 1979 and approved by the OSO on April 13, 1979 subject to 13 Conditions of Approval contained in that approval letter. Semi-annual environmental data reports are submitted every January 15 and July 15.

The Interim Monitoring and Development Monitoring Programs have been reduced and changed from the Environmental Baseline Monitoring Program in many areas. Therefore, emphasis is now placed on key indicators of environmental quality and/or change. The 1980 C.B. Annual Report, Volume 2 provides detailed data analysis as in 1979. This summary is essentially the same in both Volumes 1 and 2.

9.2 Purpose

The purpose of this report is to fulfill the requirement of the lease to provide the Oil Shale Supervisor's Office with an annual report of environmental analyses. The Development Monitoring Plan states the following objectives with respect to environmental monitoring:

> The purposes or objectives of environmental monitoring as defined in Section 1 (C) of the Stipulations are to provide: (1) a record of changes from conditions existing prior to development operations, as established by the collection of baseline data, (2) a continuing check on compliance with the provisions of the Lease and Stipulations, and all applicable Federal, State and local environmental protection and pollution control requirements, (3) timely notice of detrimental effects and conditions requiring correction, and (4) factual basis for revision or amendment of the Stipulations.

Volume 2 documents the analyses and conclusions relative to assessment of potential environmental impacts and trends that may be indicated in the collected data. Since development activities were not started until 1978, much of the data and analyses may be considered as a continuation of environmental baseline and background definition.

9.3 Summary of Environmental Monitoring

Environmental monitoring and analyses are continuing on Tract C-b. Development activities commenced within the past three years have resulted in increased activity on the Tract in the form of off-road vehicular use, facility construction, shaft sinking, and traffic into and out of the area. All activity has been conducted within strict adherence to environmental, permit, and lease regulations. Environmental impacts, where they exist, have been confined to the immediate area and within limits defined in the Detailed Development Plan.

9.3.1 Indicator Variables

The Development Monitoring Program has been brought into sharper focus with the identification of Class 1 indicator variables. These are key environmental variables collected at representative stations in at least monthly sampling frequency. Time series plots, generated by the computer from the data base and all to a common time scale, are updated in the semi-annual data reports to provide visual analyses of trends and interrelationships. As a statistical screening process, linear short- and long-term trends have been examined at a five percent level of significance for air and water and to 20 percent for biology; results are discussed in the respective chapters.

9.3.2 Tract Imagery

A photographic record of Tract changes has been continued through 1980 as in previous years. A 360° horizontal pan is photographed in color on a yearly basis at 35 photo points. From an aircraft overflight an aerial mosaic has been prepared (Figure 4-1). Color infrared panoramic photographs of the vegetation around springs and seeps were obtained twice during the growth season.

Landsat digital imagery was used as in previous years to monitor vegetative condition in the Tract vicinity. A new data filtering algorithm was tested and shown to be effective in change detection within and between years, based on a normalized reflectance difference index. Data from 1980 imagery were used to further refine the calibration curve of biomass vs. the normalized index in the pinyon-juniper and irrigated meadow vegetation types. During 1980, the image analysis software was acquired by the C.B. project so that the imagery techniques could be routinely used.

Image analysis showed that biomass in June 1977 was less than in 1980 in selected areas (Table 9-1). Climatological data show that 1977 was a drought year, and 1980 above normal in moisture. Increases in biomass within the growing season are also identifiable from the imagery. Increases in disturbed acreages were shown through the years as development proceeds.

9.3.3 Hydrology

A development monitoring program has been implemented to provide water quantity and quality data for the purpose of impact evaluation. Streams, springs, seeps, alluvial and bedrock aquifers, shafts and impoundments are presently monitored. The monitoring station locations are shown in Figures

TABLE 9-1

Changes in Vegetation Index for Landsat Data
(June 1980 minus June 1977)

Area	Description	% Change
1	Riparian area along Piceance Creek below discharge point	-5
2	Riparian area along Piceance Creek above discharge point	+2
3	Chained pinyon-juniper (PJ) on-tract in area of potential drawdown	+12
4	Land-application system area of potential irrigation influence	+9
5	Chained PJ control area	+11
6	Disturbed area around Production, Service and V/E shafts	+5

9-1, 9-2, 9-3, and 9-4. The present hydrologic monitoring network has been expanded over that which existed during the baseline period to comply with new requirements under the Water Augmentation Plan and Consent Decree as implemented in August, 1979.

Baseline studies indicated the mean flow for the reach of Piceance Creek adjacent to the Tract to be approximately 15 cfs. Records since then indicate no significant change in mean annual flows. One-day minimum flows there have reached less than 1 cfs. Maximum daily flows upstream and downstream of the Tract were measured as follows:

	Upstream (Sta 007)	Downstream (Sta 061)
Previous Daily Maximum (cfs)	157 (May '79)	149 (May '79)
1980 Maximum (cfs)	135 (May '80)	133 (May '80)

No significant trends in streamflow are apparent.

Short-term linear correlations between precipitation at C-b meteorology stations and flow from springs are not apparent. This would imply that events that occur on the surface of the Tract do not have a major effect on flow in the springs. There are no long-term, linear trends over time as shown by general linear modeling. General linear modeling indicates a trend for average monthly flow over the past year. The slope of each regression line is small (none are greater than 0.003 cfs/mo). Of ten springs, five show positive slope and five show negative slope. Considering these analyses, at the present time it appears that there is no effect of development activities on spring flow.

On a short-term basis, the linear model fits none of the alluvial well data. There are some long-term trends exhibiting a slightly negative slope, however these negative slopes began during baseline for some wells. Most importantly, there does not appear to be any effect of dewatering on the water of the alluvium of Piceance Creek.

Dewatering continued during 1980 and levels in wells near the shafts continued to decline. Of the C-b Tract wells, the only water level which did not decline was in WX10 and, in fact, its water level increased. The largest water level declines occurred in those wells closest to the shafts. There was a decrease of 160 feet in the water level at WX33 near the V/E Shaft. WX32 near the Service/Production shafts dropped about 275 feet. Declines elsewhere on the tract varied from four feet in WX17 in the southeast corner to about 70 feet in WX02 near the north boundary of the Tract between Sorghum and Cottonwood Gulches.

Off-tract wells and water augmentation wells showed declines based on proximity to the shafts. WX21, located south of the tract on Scandard Gulch, began declining very slightly late in the water year, with a total decline of about two feet. Wells WX19 and WX20 are both about one-half mile north of the Tract. A decline of about 55 feet was recorded in WX19, and the water level in WX20 dropped about 90 feet.

U.S.G.S. STREAM GAUGING STATION MONITORING NETWORK

FIGURE 9-1

FIGURE 9-2a SPRINGS AND SEEPS MONITORING NETWORK NEAR TRACT

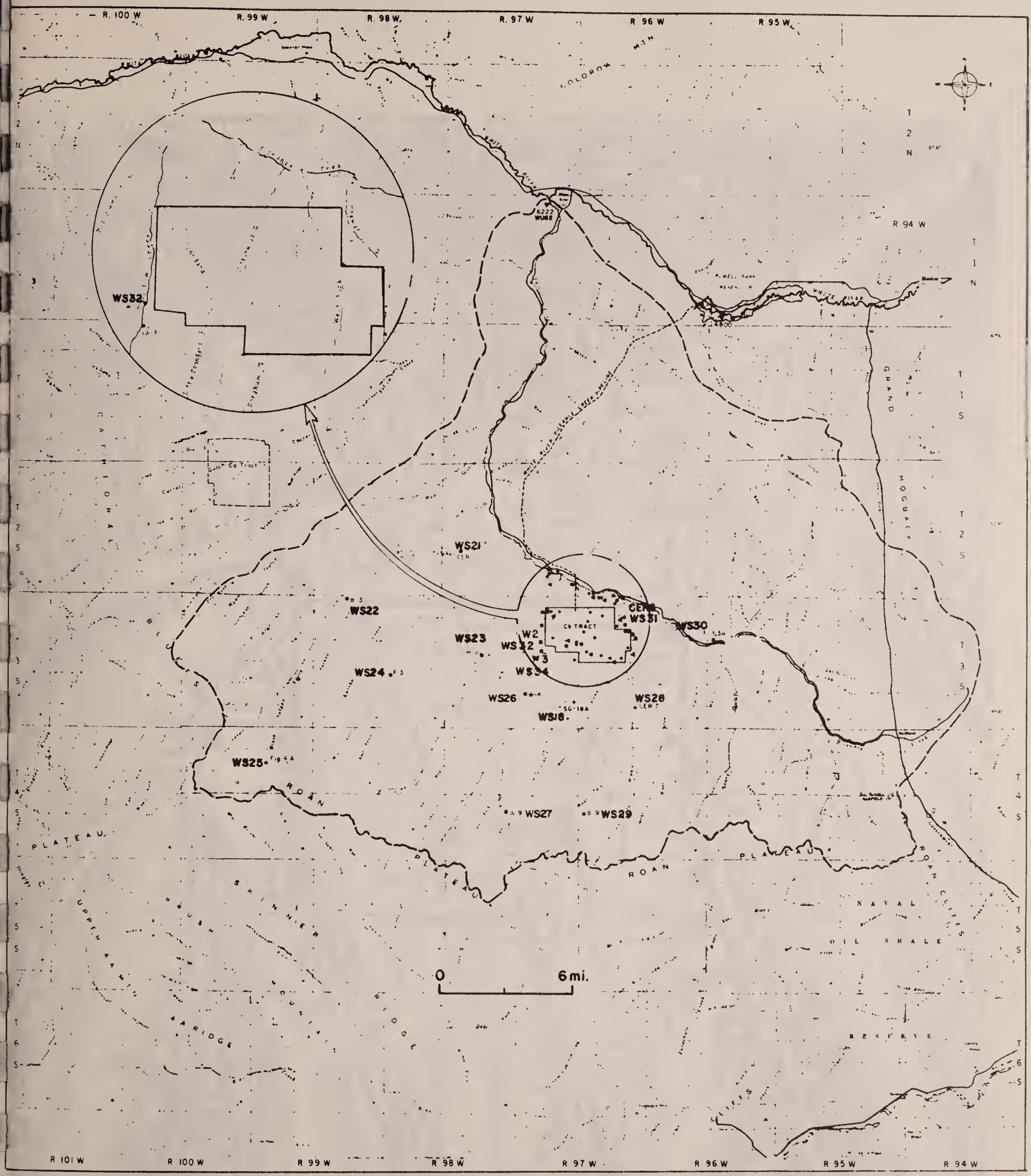


FIGURE 9-2b

SPRINGS AND SEEPS MONITORING NETWORK

OFF TRACT

FIGURE 9-3
ALLUVIAL AQUIFER MONITORING NETWORK

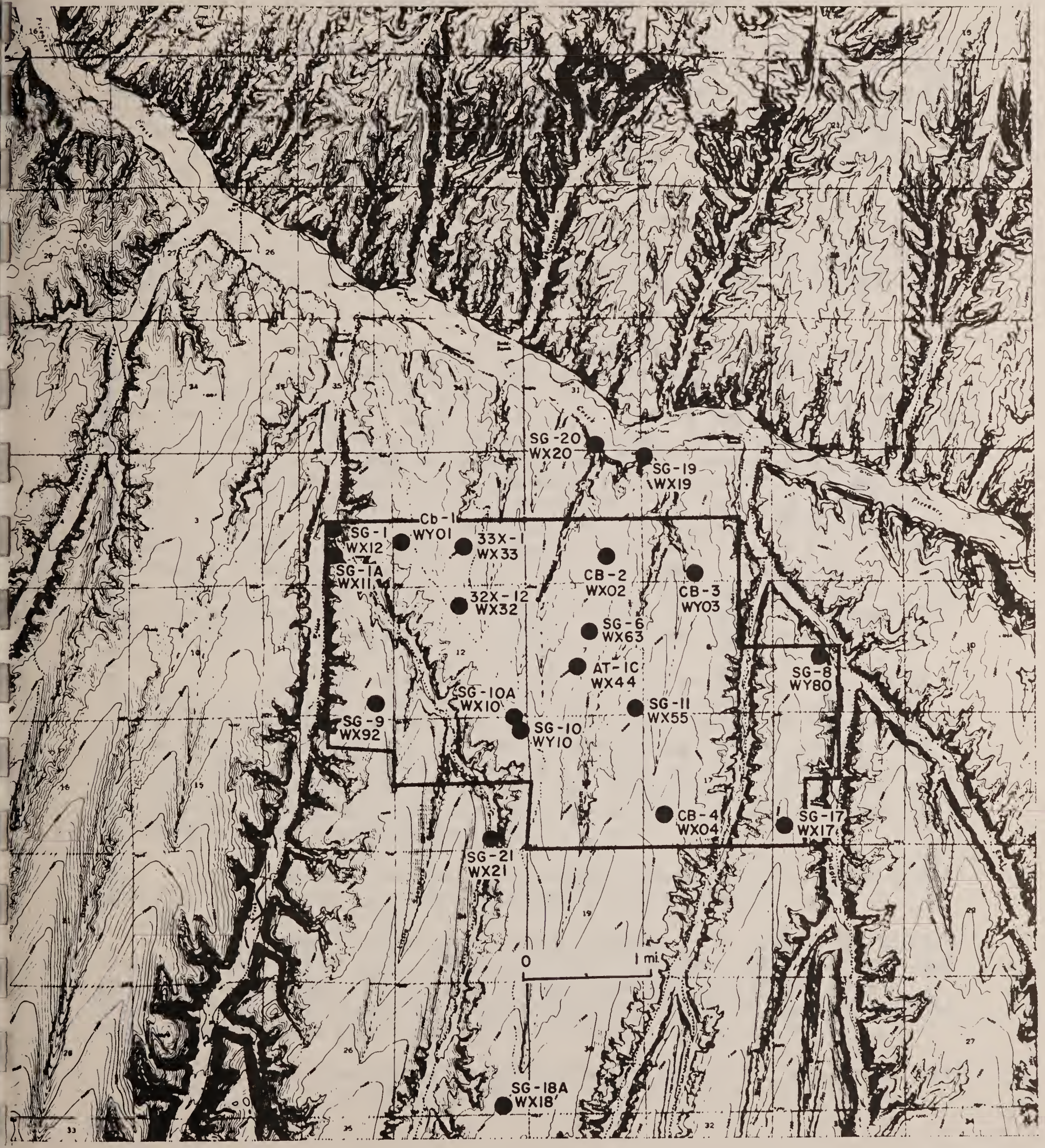


FIGURE 9-4a
DEEP WELL MONITORING NETWORK
C-b TRACT

Figure 9-4b DEEP WELL MONITORING NETWORK OFF-TRACT

Remote off-tract wells showed no declines in water levels. Some wells, for example, WX67, WX72, WX64, showed slight rises in water levels on the order of one foot. WX73 and WX75 showed no changes.

Table 9-2 summarizes water level changes in upper aquifer wells at C-b Tract. Figure 9-5 summarizes the changes in water levels between October 1979 and September 1980. Values have been linearly interpolated from the well locations shown (as plus values); therefore the plot should be regarded as approximately only. The amount of drawdown decreases with distance from the shafts. The effects of drawdown were not significant at distances greater than two miles from the shafts.

Hydro-geological data as fracture measurements, structural data, and rock quality data were obtained in all the shafts. In addition the hydrological data related total shaft inflows during sinking, effects on the groundwater monitoring well levels, and physical mapping of zones which produced water.

Water quality data for stations upstream and downstream from the Tract on Piceance Creek, and for stations in Stewart and Scandard Gulches are summarized on Table 9-3 by comparison with baseline. Ratios of 12-month means for WU61 and WU07 are shown in Table 9-4. During 1980, discharges were made under the NPDES permit and Station WU42 measured water quality affected by these discharges. Increases in concentrations at WU42 were concomitant with discharge timing and amounts, but differences in concentrations upstream and downstream in Piceance Creek were not marked except for ammonia, which was attributed primarily to livestock operations although mine-water seepage monitoring wells in 1980 are also higher in ammonia (Table 9-5). There was no change in fluoride on an annual-average basis. At the four major USGS stations, linear trends were shown for arsenic at WU07 with a very slight positive slope, and for dissolved organic carbon at WU22. Dissolved oxygen showed very slight negative slopes at WU22, WU58, and WU61 that may have been temperature dependent.

Springs water quality data show few trends with time, except for arsenic which shows a negative slope in the linear regression with time. Specific conductivity data show consistent means and standard deviations indicative of a possible common source. Specific conductivity values are also much lower for springs than for wells or surface streams indicating the probability that the springs may be precipiation derived. Baseline data for fluoride are two to three times greater than subsequent values implying that fluoride as well as arsenic concentrations are decreasing.

Alluvial well water quality data showed negative linear trends with time for some wells or showed no trends at all in others.

Upper aquifer water quality showed little change. Regression line slopes were either very slightly positive or negative. All were very near zero except TDS at WX10 which showed a significant negative slope. Linear trends in lower aquifer data were essentially zero except for a slight negative slope in magnesium at WY51.

Seepage monitoring wells show some effects of impoundments and

TABLE 9-2

UPPER AQUIFER WELLS AT C-b TRACT SHOWING MEAN
QUARTERLY WATER ELEVATIONS AGAINST MEAN BASELINE
(FEET)

Location			January-March 1979		April-June 1979		July-September 1979		October-December 1979		January-March 1980	
Computer Code	Station	Baseline Average*	Elevation	Elevation - Baseline	Elevation	Elevation - Baseline	Elevation	Elevation - Baseline	Elevation	Elevation - Baseline	Elevation	Elevation - Baseline
WX02	Cb-2	6404	6401	-3	6397	-7	6391	-13	6386	-18	6368	-36
WX04	Cb-4	6617	6629	12	6629	12	6633	16	6661	44	6638	21
WX10	SG-10A	6576	6580	4	6559	-17	6539	-37	6553	-23	-NO	DATA-
WX12	SG-1	6365	6366	1	6364	-1	6360	-5	6356	-9	6353	-12
WX17	SG-17	6640	6636	-4	6638	-2	6644	4	6639	-1	6638	- 2
WX19	SG-19	6375	6371	-4	—— NO DATA ——		6366	-9	6362	-13	6349	-26
WX20	SG-20	6358	6358	0	6358	0	6352	-6	6347	-11	6325	-33
WX21	SG-21	6705	6706	1	6707	2	6702	-3	6734	29	6705	0
WX44	AT1C-3	6547	6540	-7	6541	-6	6538	-9	6535	-12	6530	-17
WX55	SG-11	6546	6564	18	6560	14	6556	10	6556	10	6550	3
WX63	SG-6	6546	6511	-35	6510	-36	6508	-38	6505	-41	6527	-19
WX92	SG-9	6515	6499	-16	6511	-4	6508	-7	6508	-7	6489	-26
WX32	32X-12	6473***	6470	-3	6473	0	6453	-20	6434	-39	-NO	DATA-
WX33	33X-1	6380**	6378	-2	6362	-18	6315	-65	6331	-49	-NO	DATA-

* - Mean Elevation computed using data from 10/74-12/78
** - Mean Elevation computed using data from 6/78- 3/79
*** - Mean Elevation computed using data from 9/77-12/78

Figure 9-5 Drawdown of (Upper Aquifer) Water Levels Between October 1979 and September 1980

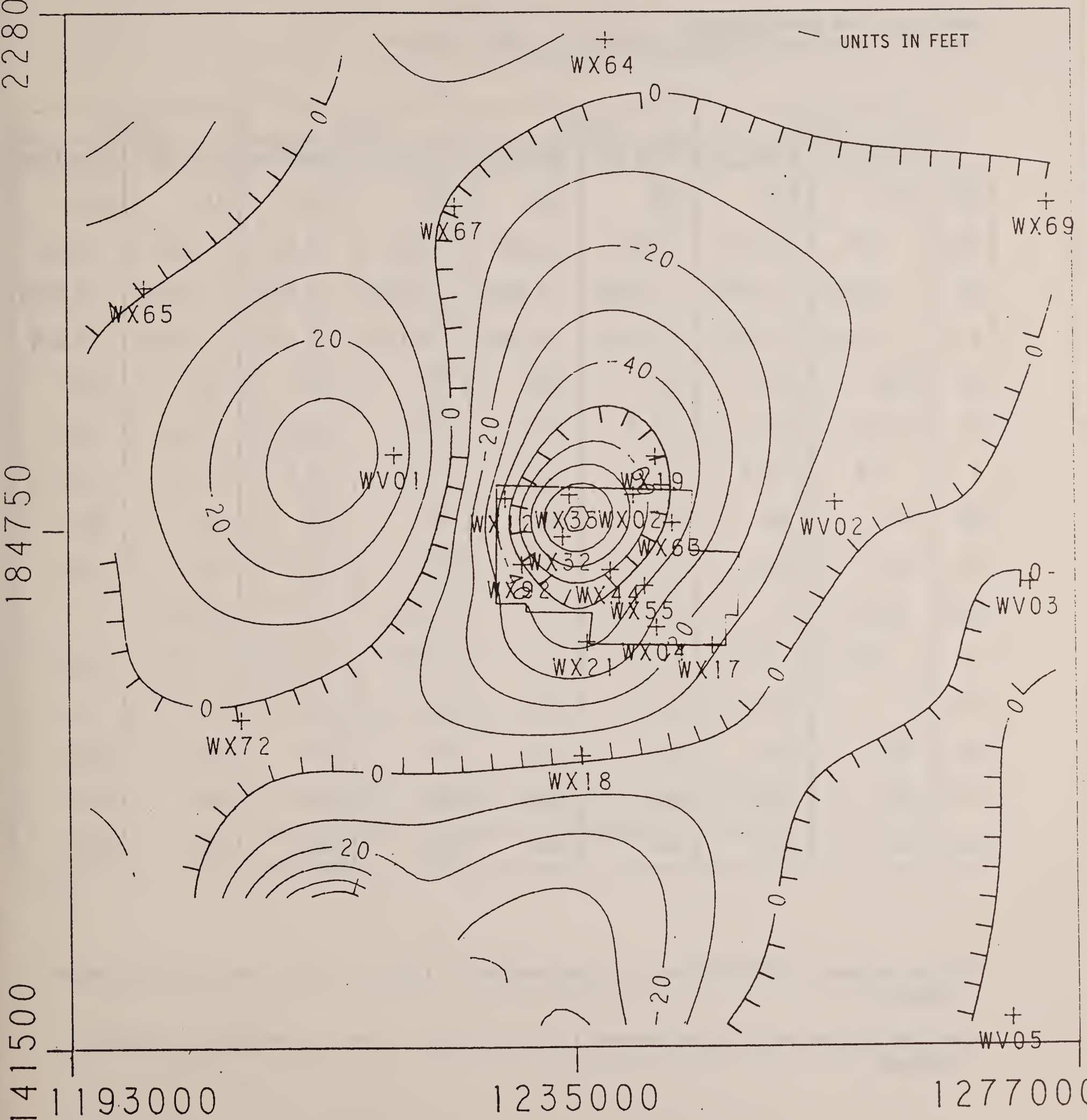


TABLE 9-3

Comparisons of 1980 Water Year vs. Baseline for
Mean Values of Major Constituents
Values are in mg/l

Baselines are mean values
Station values are 12-month averages, 10/79 - 9/80

	WU07		WU22		WU58		WU61	
	1979-80	Baseline	1979-80	Baseline	1979-80	Baseline	1979-80	Baseline
Alk	386	422	405	403	377	402	412	465
NH_3	0.04	0.04	0.02	0.02	0.07	0.02	0.07	0.03
As	0.0031	0.0024	0.0018	0.0010	0.0020	0.0011	0.0030	0.0023
B	0.184	0.209	0.104	0.108	0.130	0.210	0.187	0.214
Ca	68	69	86	93	86	92	70	78
Cl	11.6	15	6.9	7.2	10.8	11.5	11.5	14
F	0.8	0.9	0.4	0.3	0.4	0.4	0.8	0.9
Mg	44	46	69	76	67	76	55	67
Mn	45	46	9	10	12	14	34	66
DOC	13.6	-	10.9	-	8.7	-	16.7	-
K	3.2	3.6	1.5	1.6	2.2	2.2	3.5	3.5
Si	16	15	14	15	16	15	16	17
Na	111	122	125	124	112	128	128	150
TDS	667	692	885	936	835	926	782	902
SO_4	177	164	133	368	313	356	240	290

Station values in 1979-80 are for the months of 10/79 to 9/80 from U.S.G.S. water analyses.

Baseline values are for the period 11/74 to 10/76 - from environmental baseline program.

TABLE 9-4

Ratios of 12 month means, 10/79 - 9/80

	1979-80, WU61/WU07	Baseline, WU61/WU07
Alk	1.06	1.10
NH_3	1.75	0.75
As	0.97	0.96
B	1.02	1.02
Ca	1.03	1.13
Cl	0.99	0.93
F	1.00	1.00
Mg	1.20	1.46
Mn	0.76	1.43
K	1.09	0.97
Si	1.00	1.13
Na	1.15	1.23
SO_4	1.36	1.77
TDS	1.17	1.30

From U.S.G.S. stream monitoring data, 1979-80, and Oil Shale Tract C-b Environmental Baseline Program.

TABLE 9-5

Comparison of Data from WW12 and WW13 with Data from WW13 Before Impoundment

	Baseline (WW13 prior to filling Pond C - 1979 Annual Report, Vol 12, PG 114)			Water Year 1980 WW 12			Water Year 1980 WW13		
	Mean	Range	Standard Deviation	Mean	Range	Standard Deviation	Mean	Range	Standard Deviation
Conductivity	1200	600	270.8	813	240	75	1327	790	215.5
SO_4	500	164	66.8	308	400	105	430.8	270	74.6
Ca	57	15	6.6	22.7	89	26.1	59	79	19.7
TDS	1250	1000	500	630.8	1060	296.6	998	20	5.8
Alk	368	40	18.9	159	510	149	405.8	60	21.9
NH_3	0.25	0.50	0.21	9.6	13.8	4.3	0.5	2.9	0.8
CO_3	10	37	18.5	64.3	101	35.1	14.3	81	31.3
HCO_3	357	80	38.6	81.3	601	174.5	390.8	110	35
B	0.13	0.1	0.05	0	0.3	0.1	0.05	0.29	0.13
F	0.15	0.1	0.06	1.1	2.6	0.7	0.16	0.59	0.17
Na	178	10	5	132.7	60	21.5	181.7	20	5.8
Coefficient TDS/Conductivity	1.07	0.83	0.4	0.6	0.3	0.1	0.8	0.6	0.257

these data are summarized in Table 9-5. Data before impoundment, however, are based on only four samples. Table 9-6 summarizes general trends in the V/E shaft water quality. The general trend in the "A" Groove is that values increase with depth. From the base of the Uinta to the base of the Four Senators, values of TDS and NO_3 are constant with depth except for one high value for NO_3. Values of NH_3 decreased with depth and values of B increased with depth. In the Upper Parachute Creek above the A groove, values of TDS and Na increase with depth, while values of NH_3 increase irregularly with depth. Values of NO_3 and F are constant within a narrow range of values. Values for SO_4 are very irregular and have no trend. In the Mahogany Zone values of TDS, SO_4, and Na increase with depth to about 5,390 feet and then decrease with depth. Values for NO_3 and Cl are constant. Values for NH_3 and B have an irregular profile when plotted against depth with NH_3 irregularly increasing with depth and B irregularly decreasing with depth. Values of F are also irregular with maximum values in the lower (deeper) zone.

9.3.4 Aquatic Ecology

Benthos and periphyton data were obtained and analyzed in 1980. The analysis of the periphyton data at present does not show any effect that may be attributable to Tract operations. Although statistical analysis does show significant differences between stations and months, no trend relating these differences to the control stations versus the two test stations was established. The variability in the data indicated by statistical analysis is deemed to be due to natural causes.

9.3.5 Air Quality

Figure 9-6 shows the air quality monitoring network. Compliance with State and Federal air quality standards continued to be maintained at the C-b site during 1980. Concentrations in 1980 were monitored at levels far below the appropriate standards as shown in Table 9-7. High particulate values in 1974 were due to fugitive dust. Results of a linear time-trend analysis are shown on Table 9-8. Negative trends in carbon monoxide concentrations were indicated at both 020 and 023 for both short- and long-term data. Short-term represents 1980 data; long term represents data since baseline. Linear trends indicated for the other pollutants are accompanied by regression line slopes of essentially zero. That is, there are no significant trends in air quality due to development. Table 9-9 shows the maxima, means, and ratios of maximum-to-mean concentrations of gaseous and particulate constituents at stations AB20 and AB23 for 1980.

9.3.6 Meteorology

Figures 9-7a and 9-7b show the climatological network.

Meteorological data gathered during 1980 showed that monthly mean and variations in temperature are consistent with the values from the past five years since baseline. A new maximum growing season length of 151 days from 12 May to 15 October was established during 1980. Solar radiation remained in normal range and relative humidity measurements are consistent. Precipitation in 1980 was variable from month to month with annual totals of 35 cm at AB20 and

TABLE 9-6

General Trend of Water Quality Selected Parameters through Vertical Stratigraphy in V/E Shaft

Parameter	Stratigraphic Unit			
	UPC1	UPC2	A Groove	Mahogany Zone
TDS	Constant - 1300 μmhos	Rising - 1300-1500 with depth	Rise - 1300-1700	Rise to 2000 at 4395', then abrupt drop to 1000 μmhos
NH_3	Decrease - 1.3 mgl to 1 mgl	Irregular, but rising 1 mgl to 1.5 mgl	Rise	Irregular but rising trend, "W" shaped
Boron	Rise 0.6 mgl - 0.8 mgl	Irregular profile	Rise	Irregular but decreasing
NO_3	Constantly less than 5 mgl with spike to 48 mgl	Constant	Constant	Constant
F	Irregular profile	Constant between 15 mgl and 19 mgl	Rise 15 mgl to 28 mgl	Irregular shaped
Cl	—	Irregular, min. 7 mgl, max. 65 mgl	—	Constantly less than 10 mgl
SO_4	—	Very irregular, no trend	—	Rise to 100 mgl at 5394', then decline to zero
Na	—	Rising from 500 mgl to 670 mgl	—	Rise to 860 mgl at 5394', then abrupt decline to 420 mgl

AMBIENT AIR QUALITY DEVELOPMENT MONITORING NETWORK

Note: ( ) = Systems Dependent

FIGURE 9-6

TABLE 9-7

Comparisons of Maximum Background Levels with Ambient Standards

Applicable Standard	Constituent	Averaging Time	Standard Limit ($\mu g/m^3$)	Maximum Reading ($\mu g/m^3$)	Data Precision ($\mu g/m^3$)	Station With Max. Reading	Date of Maximum Reading
Colorado Ambient Air Quality Standards	Particulates	Annual	75	14.5	0.6	023	1978
	Particulates	24-Hour	260	178(1) 162(2)	11 10	024	11/27/74(1) 11/29/74(2)
	H_2S	1-Hour	142	72.2	8	023	12/22/74
National Ambient Air Quality Standards							
Primary	SO_2	Annual 24-Hour	80 365	1.3 43.1	15 15	021 & 024 021	1974 - 1975 6/16/75
Secondary	SO_2	3-Hour	1300	87.7	15	023	12/21/74
Primary	NO_2	Annual	100	5.0	6	020	1975 - 1976
Primary	Particulates	Annual 24-Hour	75*** 260	11.0 178	0.6 11	023 024	1978 11/27/74
Secondary	Particulates	Annual 24-Hour	60*** 150	11.0 178(1) 162(2)	0.6 11 10	023 024	1978 11/27/74(1) 11/29/74(2)
Primary	CO	8-Hour 11-Hour	10,000 40,000	4501.9 4650.9	100 100	020 020	6/03/75 6/04/75
Primary	Oxidant	1-Hour	240(3)	246.0(4)	20	023	1/20/79

*** Geometric mean

(1) Highest maximum reading

(2) Second highest maximum reading

(3) Standard is exceeded if $\geq$ 3 expected exceedances occur above this value over a three year interval

(4) Represents the only exceedance to date

TABLE 9-8

Summary of Air Quality Trend Analysis
Trailer 020 and 023
Units are $\mu g/m^3$

Indicator Variable		Short Term (1980) 020	Short Term (1980) 023	Long Term (Since Baseline) 020	Long Term (Since Baseline) 023
SO_2	1.	0.2944/12	0.4300/12	0.2650/39	0.3083/70
	2.	0.6108	0.0349	0.4229	0.5884
	3.		-0.0027		
	4.		0.3730		
NO_x	1.	0.5369/12	0.6726/12	4.1871/52	1.1733/69
	2.	0.0006	0.8292	0.0045	0.0033
	3.	0.0039		-0.0042	-0.0011
	4.	0.7043		0.1506	0.1220
NO	1.	0.1342/12	0.3026/12	2.7330/52	0.7499/70
	2.	0.0037	0.3539	0.0241	0.0052
	3.	0.0012		-0.0028	-0.0008
	4.	0.5871		0.0976	0.1092
NO_2	1.	0.4069/12	0.4877/12	1.4530/52	0.6601/69
	2.	0.0016	0.1856	0.0002	0.5584
	3.	0.0027		-0.0014	
	4.	0.6478		0.2433	
O_3	1.	25.5337/12	38.5128/12	27.8179/52	37.2919/71
	2.	0.2845	0.2919	0.0052	0.0174
	3.			-0.0045	0.0037
	4.			0.1462	0.0793
CO	1.	64.5982/12	88.0740/12	405.4950/45	454.5643/64
	2.	0.0086	0.0012	0.0001	0.0001
	3.	-0.4304	-0.7572	-0.4471	-0.4852
	4.	0.5150	0.6690	0.5457	0.4179
H_2S	1.		0.4476/12	0.0613/23	0.4836/69
	2.		0.1773	0.7670	0.0005
	3.				-0.0005
	4.				0.1654
TSP	1.	10.1545/12	10.8208/12	12.0058/52	12.1053/75
	2.	0.1044	0.2457	0.3894	0.2595
	3.				
	4.				

NOTE: Entries in the table mean the following:

1. Mean/Number of paired observations
2. α - to be compared with selected α. (α = selected level of significance = 0.05. If $\alpha < 0.05$, a trend exists.)
3. Slope - slope is units per month
4. r^2 value (correlation coefficient)

TABLE 9-9

Maximum, Mean* and Max/Mean Ratio**
for Air Quality Constituents

Constituent	Symbol	Station AB20			Station AB23		
		Max	Mean	Max/Mean	Max	Mean	Max/Mean
Nitrogen Dioxide	NO_2	26	0.7	27	41	0.8	51
Sulfur Dioxide	SO_2	21	2.0	11	21	1.1	19
Hydrogen Sulfide	H_2S	-	-	-	111	1.0	111
Carbon Monoxide	CO	1700	77.8	22	3800	91.7	41
Ozone	O_3	122	50.1	2	154	75.4	2
Total Suspended Particulates	TSP	49	8.4	6	41	9.1	4

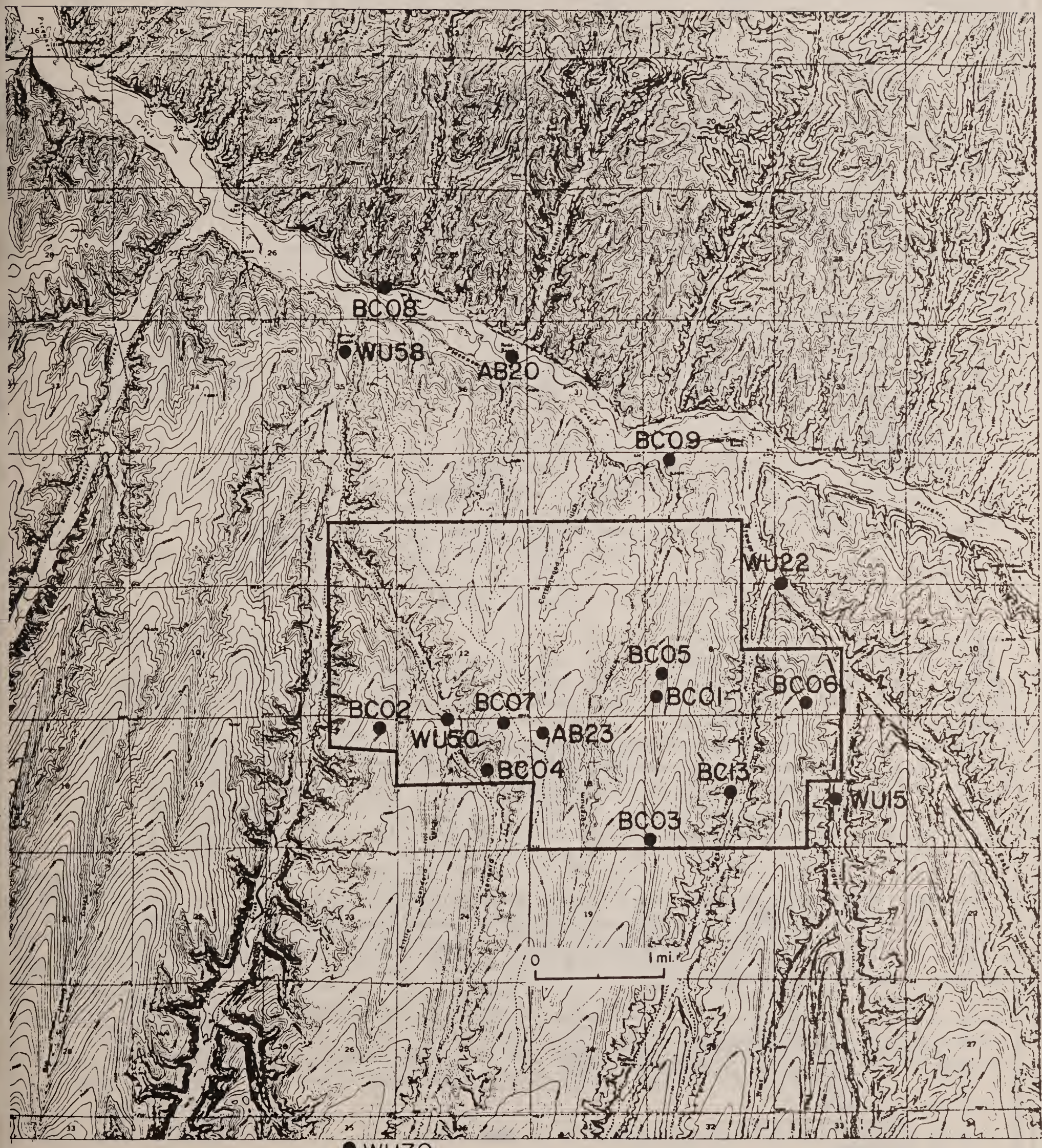
[1] Arithmetic Means

[2] Based on 1-Hour Averages

[3] Units are $\mu g/m^3$

[4] Units are ppp

FIGURE 9-7a
CLIMATOLOGICAL NETWORK
NEAR TRACT



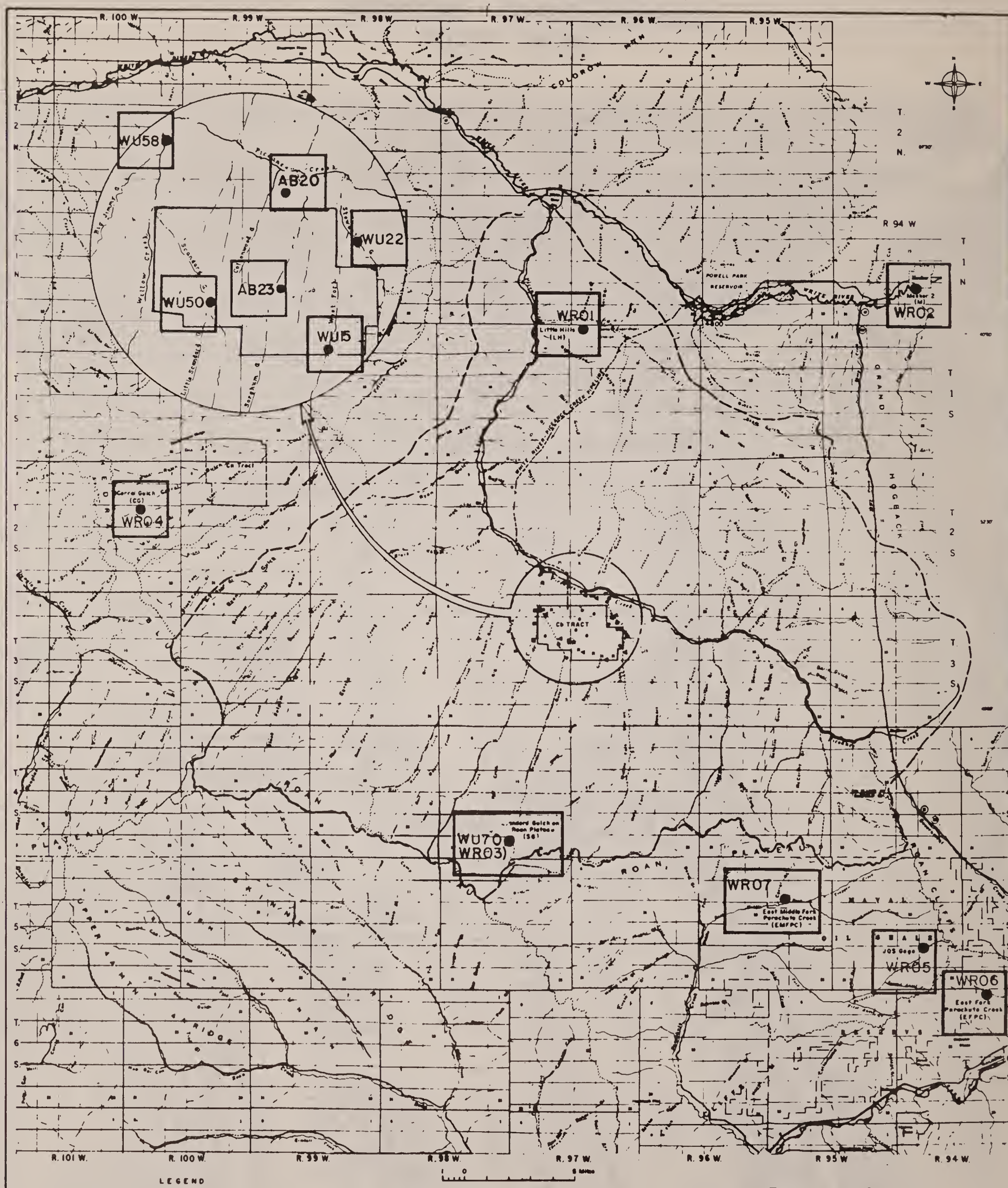


FIGURE 9-7b
CLIMATOLOGICAL NETWORK
OFF-TRACT

27 cm at AB23. Differences in the amounts recorded at the two stations are a result of the spatial variability that is typical in the region.

9.3.7 Noise

Monthly peaks in traffic noise levels and background levels during development exceed baseline levels by approximately nine dBA. Increased noise is due to development activities. These activities have produced noise levels on-Tract that are generally low (approximately 44 dBA average) and well below State noise standards for an industrial zone.

9.3.8 Wildlife Biology

Figure 9-8 presents the biological network also showing areas of the land application system.

Deer pellet group densities were higher in 1979 and 1980 than in 1978 and 1979. Their migrational movements and distribution along the highway have remained the same over the years. The 1980 high count was 1409 and occurred in April. Deer mortality was higher in 1979-1980 than in the previous years 1977-1979. Fawn counts were lower in 1980 than in 1979.

Road kills vary in numbers over the years. Road kills appear to be dependent upon herd size, traffic density, and weather conditions, although more data are required to adequately define the relationship.

Bitterbrush utilization by deer was lower in 1980 than in 1979, and is not significantly affected by C-b development.

No significant trends in coyote abundance were apparent in 1980.

Lagomorph populations are not significantly affected by C-b developments and no significant difference has been detected in preference between chained rangeland and pinyon-juniper habitats.

Small mammal populations were sampled in the areas where sprinkler irrigation occurred and central areas and the results compared. Deer mice avoided the watered areas, while golden-mantled ground squirrels preferred them. Trapping results for habitat preference are similar to past years. The least chipmunk prefers chained rangeland while Uinta chipmunk prefers pinyon-juniper habitat.

No significant changes in songbird densities have occurred due to C-b development. Mourning dove populations fluctuate from year to year and show no apparent effects of development. Raptor populations appear stable and the number of nesting sites show no apparent effect due to C-b development.

9.3.9 Vegetation

Bitterbrush production was lower than in 1979. No major changes have occurred in the herbaceous layer components in either the upland or

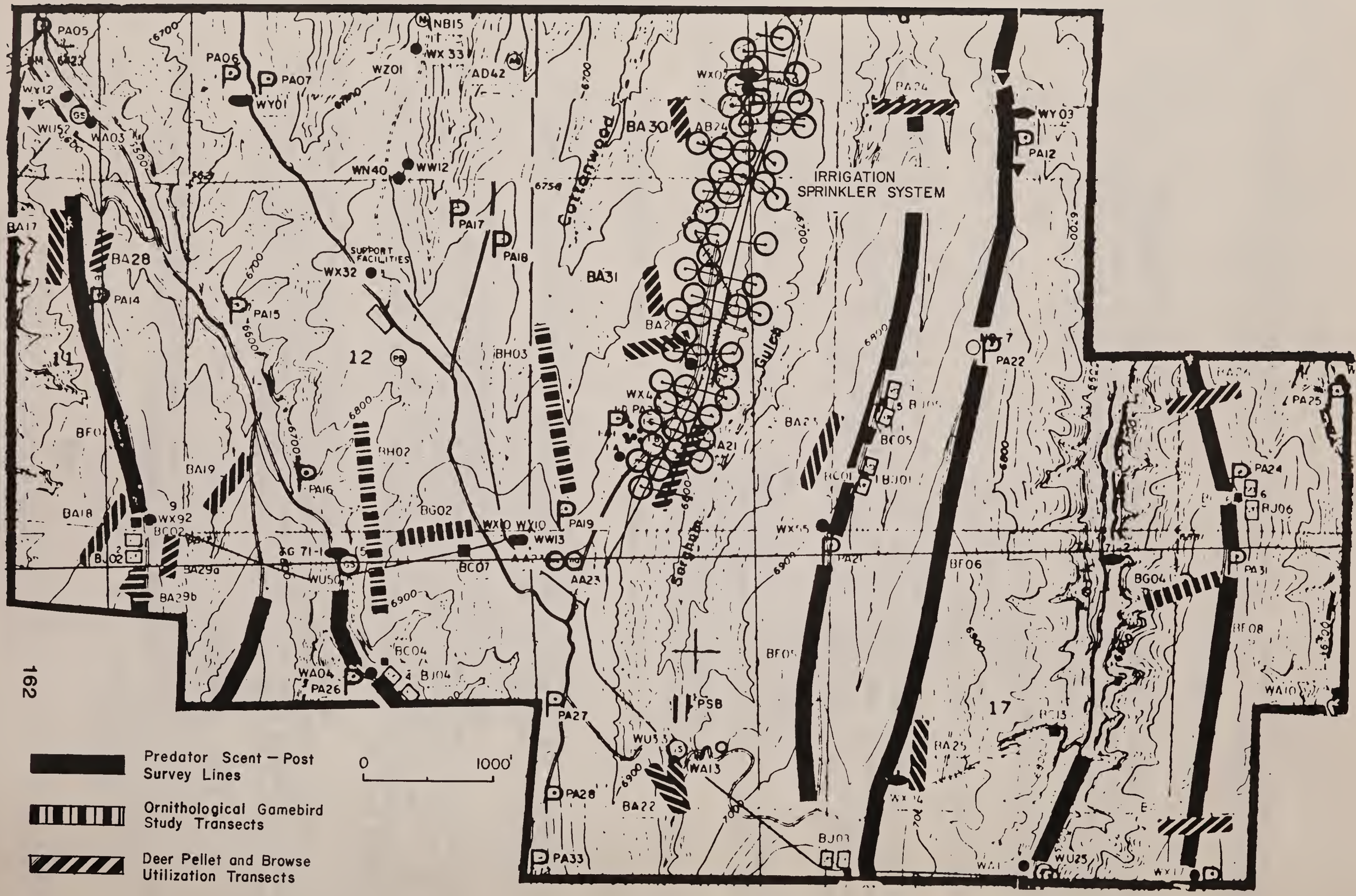


Figure 9-8 Biological Network

bottomland sagebrush shrubland types. Even though the exclosures have been in place for six growing seasons, the open and fenced plots still share a high degree of similarity. Shrub species composition has remained essentially the same. These small changes that appear seem to be related to natural variation or sampling error and do not appear to be related to oil shale development on the site.

9.3.10 Ecosystem Interrelationships

Ecosystem interrelationship studies have been continued as a means of assessing the potential impact of environmental perturbations resulting from development activity. Quantitative studies to date include the effects of climatic variations on herbaceous productivity and effects of traffic, climate, and size of mule-deer herd on deer road-kill. Previously established linear results that still hold are as follows: (1) herbaceous productivity correlated best with precipitation in April-May-June and total precipitation of the previous year; and (2) deer road-kill correlated best with deer road-count.

9.3.11 Items of Aesthetic, Historic, or Scientific Interest

Surface activity was somewhat limited at the site in 1980 as in 1979. A concerted effort has been made to paint and locate new structures to reduce any aesthetic impact. Additionally, the on-site environmental staff has thoroughly investigated every site of disturbance and no additional historic or scientific discoveries have been made.

9.3.12 Health and Safety

Accident frequency analyses and inspection reports (Mine Safety and Health Administration and Colorado Division of Mines) are included in the Development Monitoring Plan and its reports. At C-b based on 783,871 man-hours, there were 15 lost-time accidents. The site injury rate in 1980 was 5.10 (incidents/200,000 man-hours). This compared with five lost-time accidents in 1979, and an injury rate of 1.91.

9.3.13 Toxicology

Oil shale materials have been tested carefully by several research laboratories (Kettering Laboratories, University of Cincinnati; Bio-Research Consultants, Inc., Cambridge, Massachusetts; and Eppley Institute for Research in Cancer and Allied Diseases, Omaha, Nebraska) on behalf of private companies developing oil shale and at the request of the American Petroleum Institute. Detailed chemical analyses were done to measure the presence of known or potential cancer-causing substances in oil shale rock, crude shale oil and other products made from it, the rock residue left over after processing, and the air emissions from equipment during processing. In addition, experiments were conducted with mice and hamsters to determine if concentrations of such materials or extracts made from them are hazardous.

Raw and processed oil-shale rock have not shown carcinogenic characteristics in these tests. Liquid shale oil has been shown to produce skin cancer in mice as have certain uniquely processed petroleum products from

conventional crude oil. Therefore, normal care must be taken to protect workers from potential carcinogenic effects.

When shale oil is upgraded, however, its carcinogenic potential is reduced. And, since these problems have been dealt with for many years in the industry we are convinced they are manageable. In addition, the amount of BaP (a natural substance which is known to cause cancer in animals and is suspected of being able to cause cancer in humans) is greater in numerous common materials such as soil, fruit, oysters, barbequed meat, oak leaves, coal, natural sediments and ordinary paving materials than in oil shale or its products or by-products. Although man is continually exposed to these items in a normal environment, these exposures have not been associated with human cancer.

The animal studies also concluded that normal exposures to oil-shale rock by workers and the local community during processing will not present unusual toxic or cancer-causing threats. The animals were exposed to massive amounts of small particles and dust from the native oil-shale rock and from the processed oil shale by skin contact, breathing and eating. They did not develop cancer, and no unusual or chronic toxic effects were found. The relative size of the doses given the animals exceeded any possible contact by humans. As stated earlier, animals painted with raw shale oil did develop skin cancer, but this problem is preventable by proper equipment design and good industrial hygiene practices.

Overall, the results of these analyses and tests demonstrate that modern industrial hygiene and safety practices in a commercial oil shale retorting facility will protect workers and others from cancer-causing materials and toxic risks similar to other safety practices in modern industry. The combined results of these studies will help form the basis for specific safety and health programs for all oil shale facilities.

9.3.14 Data Management

All air, water and microclimate data are currently in a computerized data base called RAMIS. Biological data are partly in manual data bases, as documented in data reports to the OSO and partly in RAMIS. Status is as indicated in Table 9-10.

Data tapes for air quality and meteorology have been furnished to the OSO for data through April, 1980.

9.3.15 Reporting

Annual reports are submitted during the anniversary month of the Lease (April). Semi-annual Data Reports are submitted to the OSO on January 15 and July 15. Air quality data volumes in these reports are also submitted to EPA, Region VIII, and the Air Quality Control Division of the Colorado Department of Health.

TABLE 9-10

Status of Automated Environmental Data Base

	Automated
Water Quality	
Springs and Seeps	October 1974 thru November 1980
Alluvial Wells	"
Upper Aquifer Wells	"
Lower Aquifer Wells	"
Well Water Levels	
Water Levels	"
Water Augmentation Plan	
Springs and Seeps	July 1979 thru November 1980
Upper Aquifer Wells	August 1979 thru November 1980
Lower Aquifer Wells	"
Precipitation	January 1979 thru November 1980
National Pollutant Discharge Elimination System Data	
Water Quality Data	July 1979 thru November 1980
Air Quality	
Small Trailer (Station AB21, AB22, AB24, AB42, AD56)	October 1974 thru November 1980
Large Trailer (Station AB20)	"
Large Trailer (Station AB23)	"
Meteorological Tower (Station AA23)	"
Biology	
Microclimate	"
Deer Kill	October 1977 thru November 1980
Deer Count	September 1977 thru November 1980

Data collected and analyzed by USGS for stream flow and stream water quality are stored in government computer data bases in Reston, Virginia. These data bases (WATSTOR) and (NAWDEX) are accessed by dialing computer communications for retrievals of data to the Occidental Grand Junction computers for printing and analyses.

COUPON

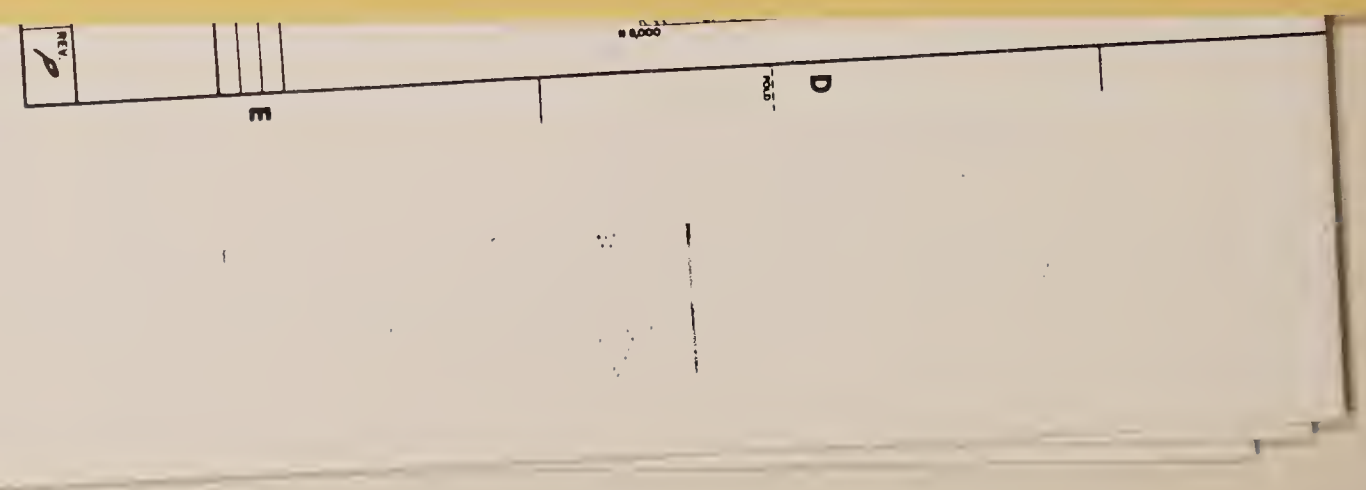
Figure 4-1 Topographic Map of C-b Tract and Figure 4-2 Aerial Mosiac of C-b Tract are full sized maps. Copies can be obtained by sending this coupon to:

Occidental Oil Shale, Inc.

750 Horizon Court

Grand Junction, Colorado 81501

Attention: Gale Kraft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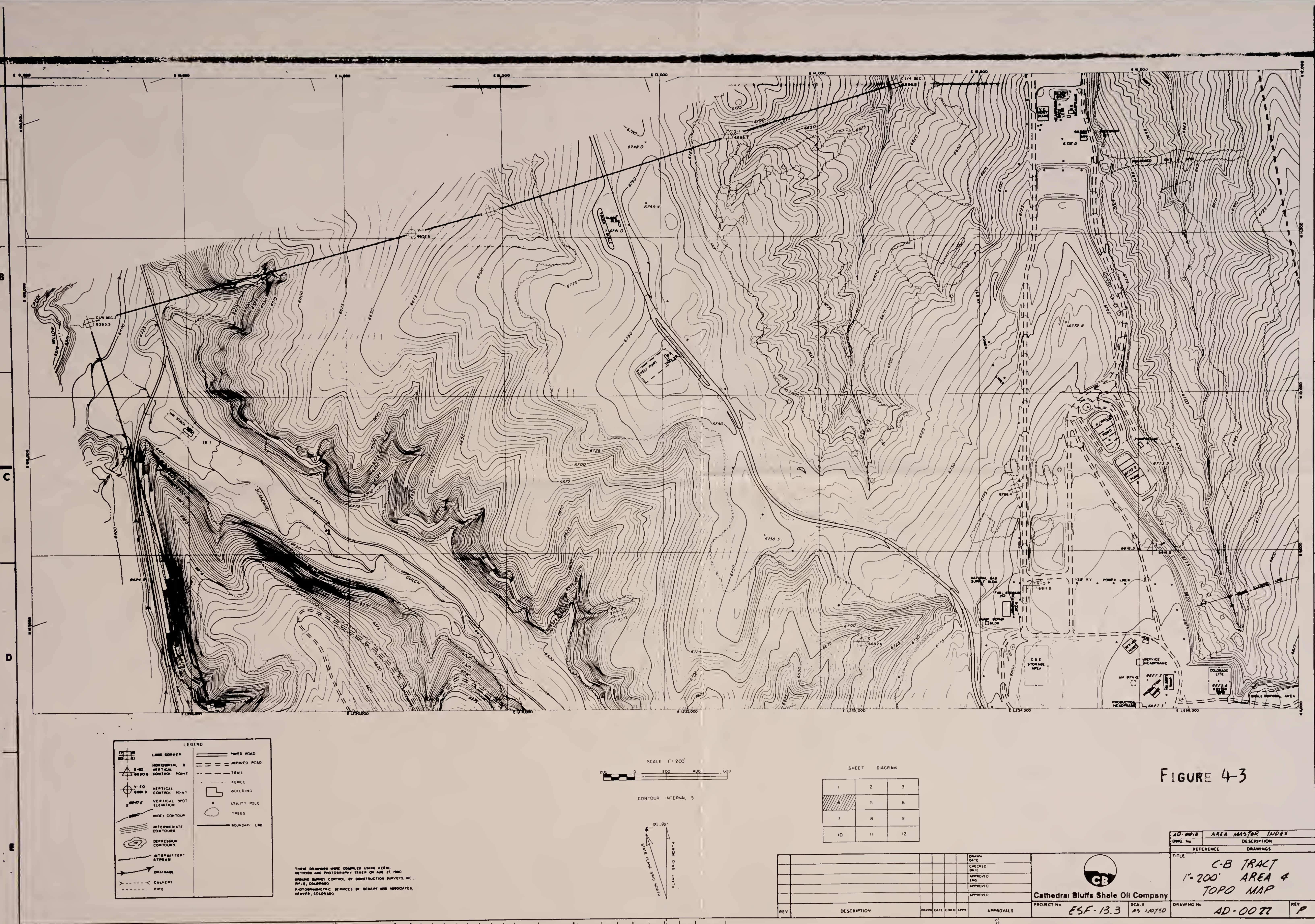
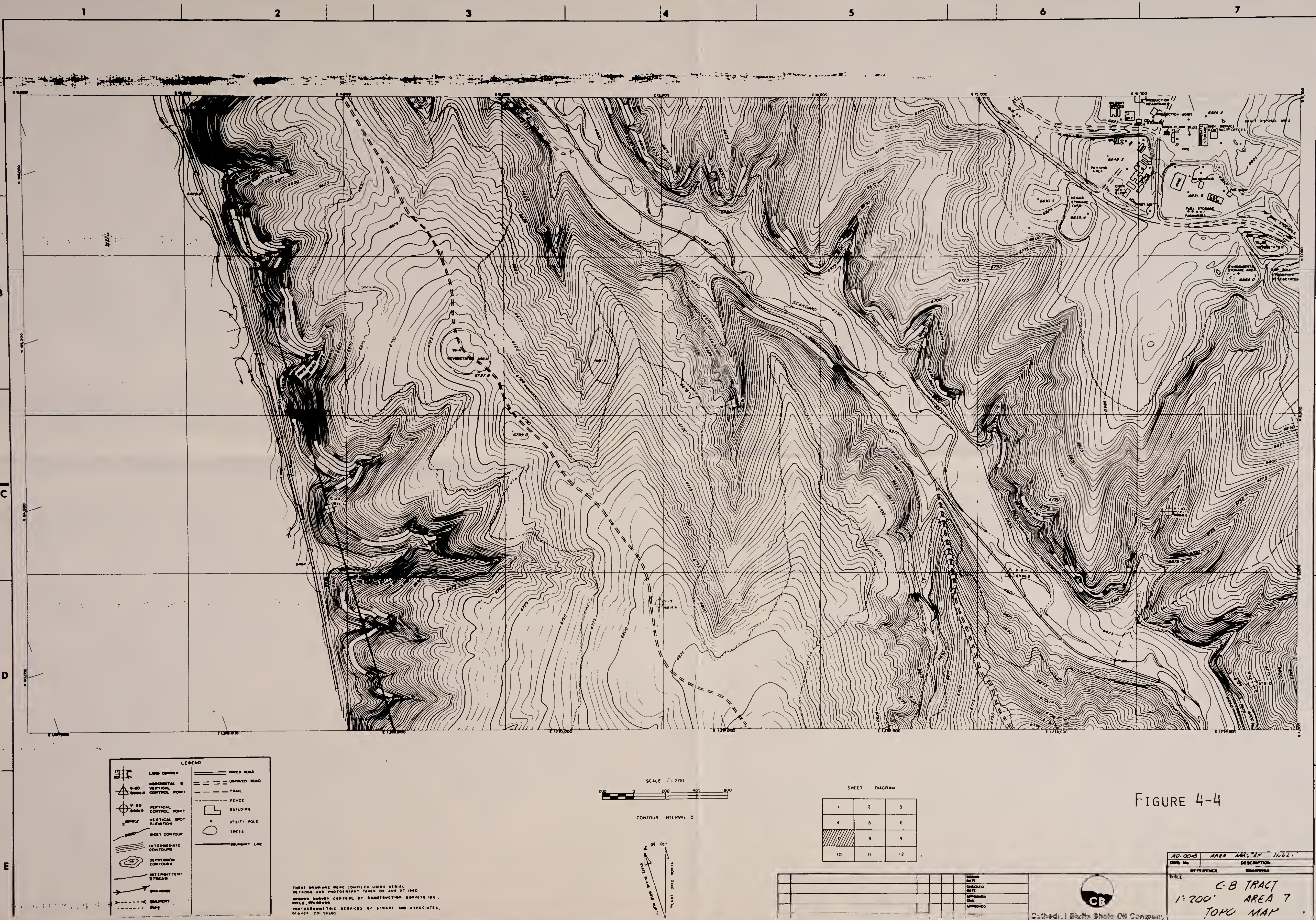


LEGEND
LAND CORNER
HORIZONTAL & VERTICAL CONTROL POINT
VERTICAL CONTROL POINT
VERTICAL SPOT ELEVATION
INDEX CONTOUR
INTERMEDIATE CONTOURS
DEPRESSION CONTOURS
INTERMITTENT STREAM
DRAINAGE
CULVERT
PIPE
PAVED ROAD
UNPAVED ROAD
TRAIL
FENCE
BUILDING
UTILITY POLE
TREES
BOUNDARY LINE
SCALE 1"=200'
CONTOUR INTERVAL 5'
STATE PLANE GRID NORTH
PLANT GRID NORTH
SHEET DIAGRAM
THESE DRAWINGS WERE COMPILED USING AERIAL METHODS AND PHOTOGRAPHY TAKEN ON AUG 27, 1980
GROUND SURVEY CONTROL BY CONSTRUCTION SURVEYS, INC., RIFLE, COLORADO
PHOTOGRAMMETRIC SERVICES BY SCHARF AND ASSOCIATES, DENVER, COLORADO
AD-0016 AREA MASTER INDEX
DWG. No DESCRIPTION
REFERENCE DRAWINGS
REV DESCRIPTION DRAWN DATE CHK'D APPR APPROVALS
DRAWN DATE
CHECKED DATE
APPROVED ENG
APPROVED
APPROVED
Cathedral Bluffs Shale Oil Company
TITLE C-B TRACT 1"=200' AREA 4 TOPO MAP
PROJECT No ESF-13.3
SCALE AS NOTED
DRAWING No AD-0022
REV P

FIGURE 4-3



THESE DRAWINGS WERE COMPILED USING AERIAL METHODS AND PHOTOGRAPHY TAKEN ON AUG 27, 1980

GROUND SURVEY CONTROL BY CONSTRUCTION SURVEYS, INC., RIFLE, COLORADO

PHOTOGRAMMETRIC SERVICES BY SCHARF AND ASSOCIATES, DENVER, COLORADO

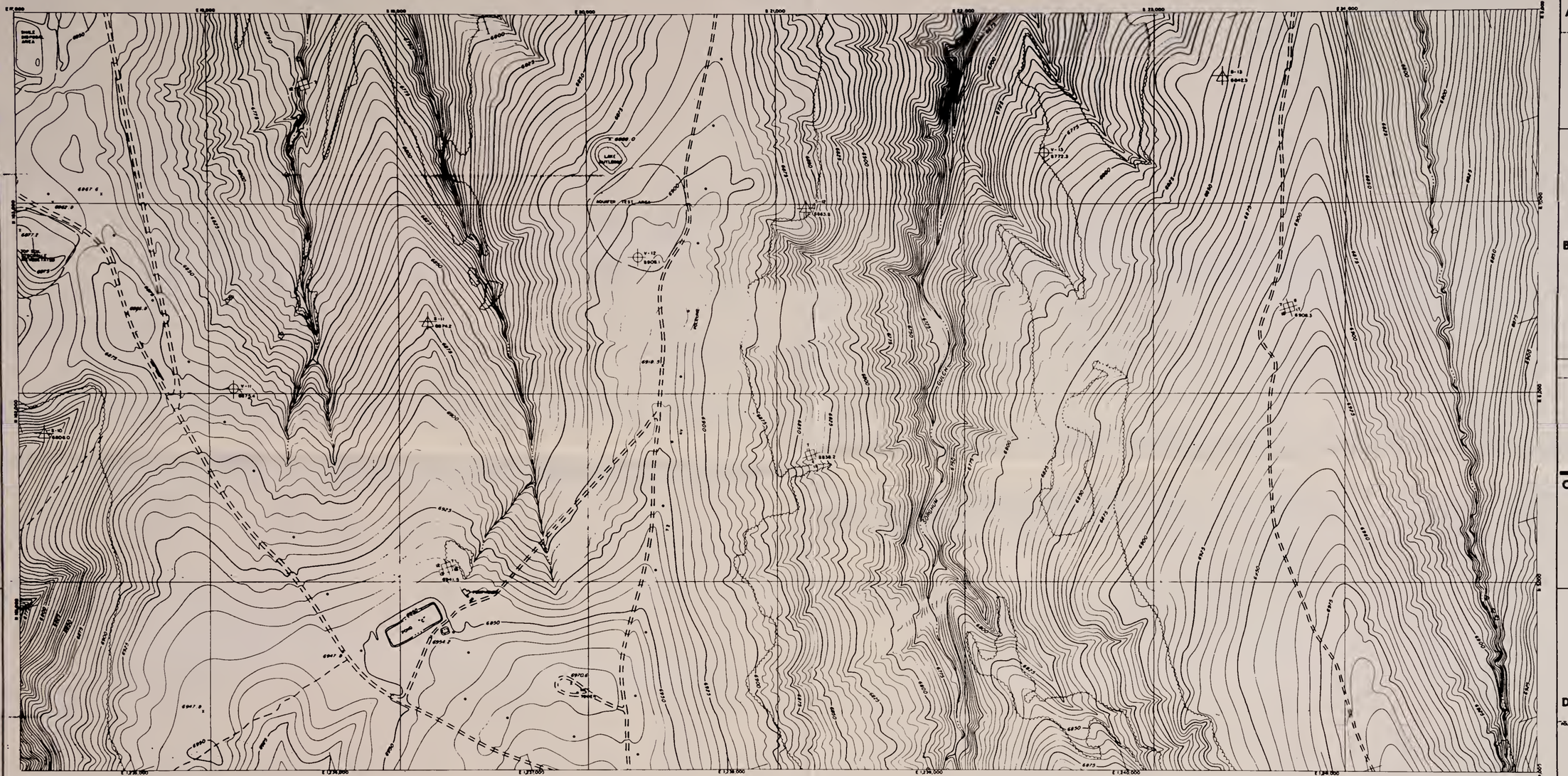
FIGURE 4-4

DWG. No.	DESCRIPTION
AD-0018	AREA MASTER INDEX
REFERENCE	DRAWINGS

DRAWN / DATE
CHECKED / DATE
APPROVED / ENG.
APPROVED

Cathedral Bluffs Shale Oil Company

TITLE
C-B TRACT
1"=200' AREA 7
TOPO MAP



LEGEND

- LAND CORNER
- HORIZONTAL & VERTICAL CONTROL POINT (S-20, 9930.6)
- VERTICAL CONTROL POINT (V-20, 9991.9)
- VERTICAL SPOT ELEVATION (6947.6)
- INDEX CONTOUR (6950)
- INTERMEDIATE CONTOURS
- DEPRESSION CONTOURS
- INTERMITTENT STREAM
- DRAINAGE
- CULVERT
- PIPE
- PAVED ROAD
- UNPAVED ROAD
- TRAIL
- FENCE
- BUILDING
- UTILITY POLE
- TREES
- BOUNDARY LINE

THESE DRAWINGS WERE COMPILED USING AERIAL METHODS AND PHOTOGRAPHY TAKEN ON AUG 27, 1980.
GROUND SURVEY CONTROL BY CONSTRUCTION SURVEYS, INC., RIFLE, COLORADO.
PHOTOGRAMMETRIC SERVICES BY SCHARF AND ASSOCIATES, DENVER, COLORADO

SCALE 1" = 200'

200 0 200 400 600

CONTOUR INTERVAL 5'

SHEET DIAGRAM

1	2	3
4	5	6
7	8	9
10	11	12

FIGURE 4-5

AD-0018	AREA MASTER INDEX
DWG. No.	DESCRIPTION
REFERENCE	DRAWINGS

DRAWN DATE
CHECKED DATE
APPROVED ENG.
APPROVED
APPROVED

Cathedral Bluffs Shale Oil Company

TITLE
C-B TRACT
1" = 200' AREA B
TOPO MAP